TROPICAL DISEASES BUREAU.

TROPICAL VETERINARY BULLETIN.

VOL. 2.] 1914. [NO. 1.

BABESIASIS (PIROPLASMOSIS) AND ANAPLASMOSIS.

(1) SERGENT (Ed.), LHÉRITIER (A.), & ISMERT (R.). **Études sur les Piroplasmoses en Algérie. 1. Sur la Piroplasmose équine en Algérie. Guérison par le Trypanbleu.** [The Piroplasmoses in Algeria. 1. Equine Piroplasmosis. Recovery after Treatment with Trypanblue.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 571–572.

This disease was first recognized in Algeria by ROGER in 1906. In 1913 the authors found a case on a farm near Algiers in a 14-year-old horse which had not left the premises for seven years.

The first symptom, consisting of oedema of dependent parts, was first seen on June 15th, and an examination of the blood six days later showed that 4 per cent. of the blood corpuscles were invaded by piroplasms. A subcutaneous injection of 5 grammes of trypanblue was given on the same day.

On the following day the animal was in about the same condition and an examination of the blood shewed that about 1 per cent. of the corpuscles contained parasites. A second dose of 5 grammes of trypanblue was administered intravenously.

Two days later there was considerable improvement in the animal's condition. The number of invaded corpuscles had fallen to about 0·3 per cent., and many of the parasites appeared to be degenerating.

By June 25th parasites seemed to have entirely disappeared from the peripheral blood, and recovery was complete a few days later.

Bovine piroplasmosis is known to exist in the district, but no case of the equine disease has been recorded previously.

(2) SERGENT (Ed.) & BEGUET (M.). **Études sur les Piroplasmoses d'Algérie. 2. Existence d'*Anaplasma marginale* Theiler chez les Boeufs d'Algérie.** [The Existence of Anaplasmosis in Cattle in Algeria.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 573–574.

The authors have examined a large number of blood preparations made from cattle shewing symptoms of piroplasmosis, obtained from a number of different districts, and have discovered anaplasma in three of them.

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In one instance the blood of an animal shewing symptoms of piroplasmosis was found to contain anaplasma, 8 per cent. of the corpuscles being invaded. No piroplasms were found.

In the second case five animals were found to be infected, the percentage of infested corpuscles varying from 4 to 70. In this case also no piroplasms were found.

In the third instance the number of invaded corpuscles was 15 per cent.

In every instance there was polychromatophilia, metachromasia, and anisocytosis.

(3) Sergent (Edm.), Lhéritier (A.), & Boquet (A.). **Études sur les Piroplasmoses en Algérie. 3. Essais de Traitement de la Piroplasmose Bovine par le Trypanbleu.** [The Treatment of Bovine Piroplasmosis by Trypanblue.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 618–622.

The authors state that, while the symptoms of Algerian bovine piroplasmosis will be discussed in a future paper, certain cases have been encountered which present a typical picture of the disease from a clinical standpoint, but in which piroplasms are either very scantily present in the blood, or quite absent. The diagnosis is justified by the clinical features presented and by the presence of other cases in which the parasite can be discovered. Further evidence is afforded by the exclusion of other diseases.

The cases described are divided into two main classes, viz., those in which the injection of the dye has appeared to be of some value, and those in which it has been valueless.

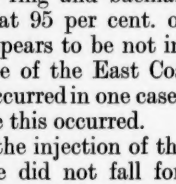
The first group contains mild or moderately severe cases, and the latter the severe cases. Of these there are three types, those in which piroplasms are very numerous in the blood, cases in which they are scanty, and cases in which no parasites can be found.

No description of the parasite is given in this paper, but mention is frequently made of small ring and bacillary forms, and, further, in one instance it is said that 95 per cent. of the red corpuscles were invaded. From this it appears to be not improbable that the author was dealing with a disease of the East Coast Fever type. Haemoglobinuria is said to have occurred in one case only, but it is not specified in what form of the disease this occurred.

Even in cases in which the injection of the drug has appeared to be beneficial the temperature did not fall for several days after. No alteration in the morphology of the parasite has been observed as a result of the injection of the dye.

(4) Sergent (Edm.), & Lhéritier (A.). **Études sur les Piroplasmoses en Algérie. 4. Infection piroplasmique intense chez des Bovidés ne présentant aucun Symptôme morbide.** [Heavy Infection with Piroplasms in Cattle shewing no Symptoms of Disease.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 622–623.

The authors have made frequent examinations of the blood of a number of Breton cattle during a period of several months dating from their arrival in Algeria.



At the time of their arrival examination of the blood shewed no parasites, but during the summer following parasites were found to be present in the blood, in some cases in large numbers.

A table is given shewing the percentage of infected corpuscles found in nine animals which were examined about once a month during the year. In six instances during the months December 1911 and April 1912 parasites were found in 0·05 per cent. of the blood corpuscles, but in July 1912 the number varied from 1 per cent. to 80 per cent. During this month eight of the animals were affected, and the ninth had shewn 7 per cent. of infected corpuscles during June. Towards the end of July the number had fallen again. According to the record given only two animals were examined on this occasion, and 2 per cent. of invaded corpuscles were found in one of them.

The only description given of the piroplasms is that they were small, and round or bacilliform.

(5) CHAMBERS (F.). **Immunisation of imported Cattle against Northern Rhodesia Piroplasmosis and Anaplasmosis.**—*Jl. Comp. Path. & Therap.* 1913. Sept. Vol. 26. No. 3. pp. 249–253.

After noting the results obtained by THEILER and BEVAN the author gives the history of two imported bulls which he inoculated against the two diseases. It was the author's intention to inoculate them with a strain of anaplasma (*centrale* variety) obtained from Pretoria, but owing to loss in the post he was unable to do so. The animals on arrival were quarantined and were kept as free as possible of ticks; only eight of the *decoloratus* variety being found on them. On the 18th day they were inoculated subcutaneously with 25 cc. of citrated blood taken from an ox brought down from Barotseland a short time previously. Both animals contracted babesiasis (redwater) and one was given an injection of trypanblue. The subsequent anaplasmosis reaction was more severe in this animal than in the other. The anaplasmosis reaction caused considerable constitutional disturbance in both animals, but treatment with quinine and iron was resorted to and both made good recoveries. They were forwarded to the owner on the 34th day after inoculation.

(6) TRAUTMANN (O.). **Anaplasmosis der Schafe in Deutsch-Ostafrika.** [Anaplasmosis of the Sheep in German East Africa.]—*Berlin. Tierärzt. Wochenschr.* 1913. Aug. 14. Vol. 29. No. 33. pp. 593–594.

The author claims to be able to confirm SCHELLHASE'S observations regarding the occurrence of this disease, and states that he observed it two years ago, though he was at the time unable to carry his investigations through.

He states that the disease has a wide distribution in Kondoa-Irangi. Young animals are principally attacked. The symptoms are:—A greenish-yellow discharge from the eyes and nose, progressive wasting, and in some cases diarrhoea. As the wasting progresses there is observed oedema of dependent parts. The disease sets in during very dry seasons and tends to disappear with the onset of the rains.

Examination of the blood shews the presence of a marginal anaplasm with a morphology exactly resembling that described by THEILER and SIEBER.

The usual abnormalities are to be observed in the blood and the lesions are those of an acute anaemia.

(7) DESCAZEAUX (M. J.). **Considerations étiogèniques, pathogèniques et therapeutiques sur la Piroplasmose des Bovidés dans l'Etat de Saint Paul.**—*Recueil de Méd. Vét.* 1913. Nov. 30. Vol. 90. No. 22. pp. 392–410.

Piroplasmosis in bovines in Saint Paul is invariably due to *Piroplasma* (*Babesia*) *bigeminum*, although CARINI has described the occurrence of *P. argentinum* in an imported animal.

The disease occurs in all parts of the country, and has been responsible in some instances for a mortality of 95 per cent. in imported animals. Adult animals are more susceptible than young ones. The transmitting tick is *Margaropus annulatus* var. *australis*. The author gives a detailed description of both sexes of this parasite.

Piroplasms are to be found in experimental cases at the seat of inoculation from the third or fourth day, although they do not appear in the circulating blood until the 7th or 8th day. These parasites are small and rounded and are often extra-corpuscular.

It is said that in cases of natural infection piroplasms can be found in blood taken from the ears before they appear in the general circulation, the explanation being that the infecting ticks are commonly found on the ears and the parasites found there are those injected by the tick before the circulation becomes invaded. It is also stated that this explains why intravenous injection of trypanblue is more effective than subcutaneous injection in natural cases of the disease.

In the treatment of the disease with this drug the author has had four deaths out of 15 natural cases and none out of 60 experimental infections. The drug is said to be more efficient when it is injected close to the seat of inoculation.

Auto-agglutination of the red corpuscles occurs before piroplasms can be detected in the blood, and becomes very marked when piroplasms are numerous.

The effect of trypanblue is to act directly upon the parasites and to cause very marked phagocytosis.

It is said that this phagocytosis is observed in animals that have been immunised against piroplasmosis, treated with trypanblue and immediately infected with anaplasma.

Parasites disappear from the blood about 20 hours after the injection of trypanblue, but they always reappear as small round bodies during the 10 to 20 days following recovery.

(8) CARPANO (M.). **Piroplasmose equina, Typi parassitari.** [Equine Piroplasmosis. The Types of the Parasites.]—*La Clinica Veterinaria.* 1913. Oct. 15/30. Vol. 36. No. 19/20. pp. 847–886. With 3 plates.

The author records the occurrence in Italy of the two types of parasites that are responsible for this disease and which have been encountered in other parts of the world. He has been able to satisfy

himself that they are distinct since he has found that animals immune to one are susceptible to infection with the other. A large proportion of native Italian horses appear to be immune to piroplasmosis, possibly as a result of infection while foals.

Clinically there does not appear to be much difference between the two types of infection, save that *Babesia caballi* appears to be responsible for more chronic cases than *Nuttallia equi*, which is the cause of more deaths. The immunity lasts for a considerable time.

The transmitting agent is *Rhipicephalus bursa*, and *Boophilus annulatus* appears to be capable of transmitting Babesia only.

(9) Darling (S. T.). **Equine Piroplasmosis in Panama.**—*Jl. Infectious Diseases.* 1913. Sept. Vol. 13. No. 2. pp. 197–202. With 1 plate.

In this paper the author describes the occurrence of a case of equine piroplasmosis at Ancon.

The animal in question was one of the first to be sent to the Canal Zone in 1904. In January 1913 it was taken to Old Panama and the Juan Diaz River, and while there was allowed to graze on the Sabannas where there were some native ponies. Four days later the animal was found to be ill with an elevated temperature. The pulse and respiration were accelerated, and after an illness lasting three days the horse died.

At the post-mortem the following lesions were found :—

No subcutaneous oedema or fluid in the serous cavities. The anterior surface of the liver shewed a number of purplish areas of necrosis measuring up to rather more than an inch in diameter and with yellow centres. None were found in the substance of the liver. The spleen was enormously enlarged, and its pulp was dark in colour and rather fluid. Its weight was estimated at 28 pounds. The blood was somewhat more fluid than normal, and on microscopic examination there appeared to be some amount of leucocytosis, with a predominance of transitional and mononuclear forms. The parasite found was that described by Nuttall and Strickland as *Piroplasma* (*Babesia*) *caballi*; parasites were scanty in the blood. Ticks removed from the horse at the time of death were identified by Nuttall and Warburton as *Dermacentor nitens* and *Amblyomma cajannense*.

(10) Laveran (A.) & Nattan-Larrier. **Piroplasmoses Canines d'Europe et d'Afrique.** [The Canine Piroplasmoses of Europe and Africa.]—*Ann. Inst. Pasteur.* 1913. Sept. Vol. 27. No. 9. pp. 701–717.

This paper contains a description of the experiments undertaken with the object of deciding whether the European and African canine piroplasmoses are identical or not.

The strains used were a French strain and a strain from Cape Colony. In order to attenuate the virulence of the piroplasms somewhat, the blood used for inoculation was placed in an ice chest for from three to seven days before it was used.

French virus. The period of incubation varied from two to five days, and of 23 dogs inoculated eight failed to become infected.

Two forms of the disease are distinguished, an acute and a sub-acute.

The acute form was most frequently seen, particularly after the second passage. Piroplasms appeared in the blood in from two to four days and death took place in from one to four days later.

In the subacute form of the disease crises occurred in from four to seven days after the appearance of parasites in the blood, and in some cases there were relapses at varying intervals afterwards. As a rule the parasites were very scanty during the relapses. Jaundice was observed in two cases only, but Gmelin's reaction was obtained with the urine containing haemoglobin in every instance.

Haemoglobinuria occurred in every dog that contracted the disease fatally, while in no case was it observed where the animal recovered.

In the acute form there are three constant lesions: anaemia, enlargement of the spleen, and congestion of the kidneys.

African virus. This virus, which was obtained from NUTTALL, was derived from a chronic case of the disease. As in the case of the French virus the inoculations were all intramuscular.

During the first five passages the period of incubation varied from 6 to 14 days, but subsequently it was reduced to 4 or 5, reaching 7 days in one instance only, when the blood had been kept in the ice chest for more than a week.

Excluding two cases in which the course of the disease was sub-acute, the average duration of the disease was 12 days, death occurring on the third day after the appearance of parasites in the blood.

Two dogs failed to become infected.

The acute form of the disease was most frequently observed, this type of infection occurring in two-thirds of the cases subsequently to the fourth passage.

The disease ran a sub-acute course in three cases only, and in two of these was followed by recovery. In these two cases the dogs were fairly old and one of them failed to become infected by the first inoculation. The second of these animals was inoculated with blood that had been preserved on ice for 10 days.

In almost every case in which the animals suffered from an acute attack of the disease there was observed haemoglobinuria, but jaundice was noted in one instance only. Bile was detected in the urine in 7 cases.

The lesions found were the same as those observed in the animals infected with the French virus.

Examination of the records shews that the only difference to be observed between the results of inoculation with the two viruses is that the African virus appears to be the more virulent. Upon these grounds cross-immunity experiments were undertaken. None of the dogs which had recovered either from the French or the African disease became infected when re-inoculated with the same strain. A bitch which had survived inoculation with both strains whelped, and one of the puppies inoculated immediately after birth with the French strain failed to become infected, while another inoculated 13 days after birth with the African strain contracted a fatal infection. The authors conclude from this that there is an immunity immediately after birth which soon disappears. In two instances the authors have shewn that the piroplasm does not pass from the mother to the foetus.

In the cross-immunity experiments dogs which had resisted infection with either strain were re-inoculated with the same strain 10 days

later, and then again inoculated with the other strain after a lapse of a further period of about ten days.

Details of these inoculations are given, and the results shew that of 7 dogs which had acquired immunity to the French strain 6 died of the disease when inoculated with the African strain, and 2 which had acquired immunity to the African strain suffered from a slight attack when inoculated with the French strain.

The authors conclude that these experiments shew a marked difference between the two strains. They point out that, if the difference was one of degree of virulence only, the immunity conferred by recovery from the disease caused by the French strain would cause the attack produced by the African strain to be of a mild character, whereas the contrary proved to be the case. Further, recovery from the African disease should confer absolute immunity against the French form of disease. This was also found not to be the case.

They conclude that the African parasite, if not a distinct species, is at least a variety distinct from the French parasite.

(11) Knuth (P.) & Richters (E.). **Ueber die Vermehrung von *Piroplasma canis* auf künstlichen Nährböden.** [The Cultivation of *Piroplasma* (*Babesia*) *canis* in Artificial Culture Media.]—*Zeitschr. f. Infektionskr. parasit. Krankh. u. Hyg. d. Haust.* 1913. Sept. Vol. 14. No. 2/3. pp. 136–144. With 2 plates.

While passing under rapid review the literature regarding the cultivation of malarial parasites and piroplasms, the authors state that their own experiments were commenced in February 1913 and were carried out independently of Ziemann.

Owing to differences in the characters possessed by piroplasms as compared with those of malarial parasites of man the authors have not closely adhered to the technique described by Bass and Johns. They point out that while piroplasms can under certain circumstances retain their vitality outside the body for a long time, the malarial parasites rapidly die, and also that the processes of multiplication of the two types of organism in the blood are very different.

It is laid down that in order to get successful cultures it is essential that there shall be only a small number of parasites present in the blood used, for if piroplasms are numerous the vitality of the organism is lowered and large quantities of inhibiting substances are present in the blood.

In order to get suitable blood it is advised that a young dog, from four to eight weeks old, should be inoculated, and if only old dogs are available for experiment, splenectomy should first be performed, and after a day or two 40 to 50 cc. of blood should be withdrawn in order to produce a temporary anaemia.

Repeated estimations have not shewn that piroplasms are more numerous in arterial blood than in venous blood, or vice versâ. Blood is withdrawn from the jugular vein and mixed with half its volume of 1 per cent. dextrose solution. The mixture is defibrinated and centrifuged, the serum and leucocytes being pipetted off. The tubes are then incubated at 40° to 41° C. Multiplication occurs during the first eight hours, and numerous, pear-shaped, elongated, and amoeboid intracorpuscular forms are to be found. Extracorpuscular forms

may also be encountered. Both the corpuscles and the parasites begin to degenerate by the 20th to 24th hour.

Subsequently certain alterations were made in the technique. The serum was not removed, a 2 or 3 per cent. solution of dextrose was used, and 1/10 cc. of 2 per cent. citrate solution was added to 5 cc. of blood. The best results were obtained when the tubes were left at room temperature, multiplication being observed up to the 6th or 8th day.

Numerous other media were tried, and ascetic fluid mixed with serum inactivated at 45° C. for an hour (proportions not stated) was found to be a good medium.

Subsequently the proportion of dextrose was increased, 1/10 cc. of a 50 per cent. solution being added to 6 cc. of blood.

Subcultures were obtained in media of composition similar to those used for the primary cultures, and it was found that the best results were obtained when the secondary cultures were made on the second or third day.

It was found possible to inoculate dogs successfully with sub-cultures and also to cultivate the piroplasms from dogs so infected.

(12) Toyoda (H.). **Züchtungsversuche mit *Babesia canis* nach der Bassschen Methode.** [The Cultivation of *Babesia canis* by Bass's Method.]—*Centralb. f. Bakt.* 1. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 76–81. With 1 plate.

The author has succeeded in obtaining cultures in the following manner :—

Tubes were prepared containing the following mixture: 10 cc. of serum from a healthy dog, 0·2 cc. of 50 per cent. dextrose solution, 0·3 cc. of 2 per cent. sodium citrate in 0·85 per cent. sodium chloride. These tubes were inactivated by incubation at 45° C. for an hour.

The blood used as seed material was treated in the following manner. Blood in which parasites had just made their appearance was withdrawn from a vein and defibrinated, and then mixed with the same materials as the healthy serum and in the same proportions. The tubes were centrifuged, and after removal of the serum and leucocytes the corpuscles were added in the proportion of 0·4 to 0·5 cc. to the tubes of serum previously prepared.

In the subcultures 0·4 cc. of freshly prepared corpuscles from a healthy dog was mixed with 0·1 cc. of the "culture-blood," the mixture being incubated at 37° C.

Details are given of a particular case from which the following particulars are taken :—

The seed material (infected blood) which was used was examined microscopically, and in 50 fields (magnification not given) 6 parasites were found. In other preparations of the same blood several parasites which had divided into 2, 4, and 8 were found. The cultures were maintained for the first 18 hours at 37° C. and then for 6 hours at room temperature, this alternation of temperature being continued.

After 18 hours parasites were found at four places in 50 fields and they shewed from 6 to 8 merozoites, the total number observed being 25.

On the second day 46 merozoites were found in 50 fields, some of them being in groups of 16. The parasites shewed an increase in size, and in many instances one end was drawn out into a fine point.

On the third day the majority of the parasites were extracorpuscular and degenerated, but at one place 20 merozoites in a condition of partial degeneration were found in a single corpuscle.

No parasites were to be found on the 6th day.

The first subculture was made by inoculating fresh tubes from the primary culture at the 18th hour. It is not stated whether the alternation of temperature was used, but multiplication occurred as shewn by the examination of films. The multiplication was not so marked as in the primary culture and by the 4th day the majority of the parasites were degenerated.

The second subculture was made from the first at the 18th hour. After 18 hours incubation there appeared to be no multiplication, but after 48 hours at room temperature there was obvious multiplication. The cultures were then incubated at 37° C. for 18 hours and further multiplication occurred. Young schizogonous forms comprising only 2 or 4 merozoites were found, indicating that fresh blood corpuscles had been invaded.

Degeneration of the parasites occurred by the 5th day. No multiplication occurred in the third subculture.

THEILERIASIS.

(13) Nuttall (G. H. F.) & Hindle (E.). **Conditions influencing the Transmission of East Coast Fever.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 321–332.

The authors have made an attempt to confirm Gonder's account of the life cycle of *Theileria parva* within the invertebrate host, but they have been unable to detect in the tissues of infected ticks any appearances which could not be found in the corresponding tissues of clean ticks. More than 20 ticks have been submitted to thorough examination.

In order to throw more light upon the biology of the parasite in the tick, a number of experiments were undertaken to ascertain the effect of various conditions upon the infectivity of the ticks. Full protocols of the experiments are given and these afford the following information.

In the first experiments it was shewn that ticks do not necessarily become clean as a result of biting a vertebrate host, and further that an infected tick does not become infective until it has fed upon a bovine for at least two days.

Secondly it was shewn that infected ticks could be fed upon a rabbit for three days before being placed upon a susceptible animal, without losing their power of infecting the bovine. In the experiments given the period of incubation was exactly the same as that in the control animal, excluding the three days spent by the ticks upon the rabbit.

Infected ticks were placed upon a susceptible calf and were removed after they had been attached for two days. The calf did not become infected, but was proved subsequently to be susceptible to infection.

It being thought possible that the non-infectivity of the ticks during the first two days spent upon a bovine animal might in some way be connected with the temperature, unfed infective ticks were heated to 37° C. for two days before they were placed upon a susceptible animal,

but this did not render them infective during their first two days spent upon it.

The fifth experiment shewed that preliminary feeding of infective ticks for two days, followed by starvation for 17 days, rendered them non-infective.

Since experiments shewed that ticks are non-infective until after they have fed for two days, it appeared to be reasonable to suppose that the failure of attempts to infect cattle by the inoculation of ticks was owing to the inoculation of parasites at an unsuitable stage of development.

Two calves were inoculated respectively with the contents of 19 engorged ticks and the salivary glands of 18 infected ticks. Neither of these became infected, but the calf upon which they were fed became infected and died.

Some experiments were carried out to test the effect of cold upon the infectivity of *R. appendiculatus* infected with *T. parva*.

Engorged larvae after being kept for about five weeks at 19° C. were found to be infective after being warmed for a single night to 37° C.

Infected ticks were found to be non-infective after having been maintained at about 10° C. for three weeks. It was found that warming the ticks thus rendered non-infective restored their infectivity.

TRYPANOSOMIASIS.

(14) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **Trypanosomes of the Domestic animals in Nyasaland. I. *Trypanosoma simiae*, sp. nov. Part II.—The Susceptibility of Various Animals to *T. simiae*.—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 48–57.**

The morphology of this parasite has been dealt with in a previous paper (see this *Bulletin* Vol. 1. No. 2. pp. 77–78); the present publication deals with the pathogenic range of the trypanosome.

The organism kills monkeys and the domestic pig in an extremely short time, but is non-pathogenic for cattle, antelope, dogs, and small experimental animals. The trypanosome is however capable of infecting the goat and the sheep.

So far as is known, the warthog is the only wild animal in the district which harbours it, and this animal is very numerously present in the low country. This explains why so large a number of infected flies are found.

The trypanosome undergoes a change of virulence with great rapidity. If a monkey and a goat be infected by means of flies, the monkey dies within a few days, but if an attempt be made to infect a monkey by inoculation with the goat's blood, the result is generally a failure.

"The organism belongs to the same group as *T. pecorum*, and it is curious that this loss of virulence occurs in the latter species also. . . . This has given rise to the erroneous idea that a separate species—*T. nanum*—exists. *T. nanum* is in truth nothing but a strain of *T. pecorum* which has lost its virulence for these animals (monkey, dog, rat) by its passage through the goat."

Tables are given shewing the results of a large number of experimental inoculations.

The following is an abstract of the summary of the results obtained :—

The opportunity has not yet been offered to test the effect of *T. simiae* upon equines. Four oxen have been inoculated, two from a monkey and two from a goat, and all have remained in good health. Five antelope have been inoculated without positive results, and the trypanosome has never been found in the blood of an antelope.

Thirty-one goats and one sheep have been infected. Passage through the fly would appear to exalt the virulence, or at least the trypanosome would appear to reach its highest virulence after passage through the fly. Of 15 goats infected by flies, 13 died in, on an average, 46 days. Three goats inoculated directly from warthogs all recovered ; this is curious, since in all probability the fly must get its infection from that species. Six goats were inoculated with blood from fly-infected monkeys. One died, four recovered, and one was refractory. Three goats out of six infected from goats died, the remainder recovering.

Of the cases of fly infection in the goat 12 were cases of mixed infection, but from the results obtained it would appear that *T. simiae* alone is as fatal as when mixed with other trypanosomes. The only symptoms presented by goats are emaciation, anaemia, and exhaustion.

In the domestic pig the disease runs a very rapid course. In nine experiments the average period elapsing between inoculation and death was 5·3 days.

When monkeys are infected directly from flies death takes place within a fortnight, and a similar result is obtained when monkeys are inoculated from other monkeys which have very recently been infected by the bite of flies. When a monkey is inoculated with the blood of an infected goat the result is generally negative.

The dog appears to be immune, as do the guinea-pig and rat. The rabbit presents a high degree of resistance.

The carrier is *G. morsitans ;* 3·4 per 1,000 were found to be infected. The reservoir of the virus appears to be the warthog. Of 33 examined three were infected.

(15) Bruce (David), Harvey (D$_4$), Hamerton (A. E.), & Lady Bruce. **Trypanosome Diseases of Domestic Animals in Nyasaland. I. *Trypanosoma simiae*, sp. nov. Part III.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87, No. B. 592. pp. 58–66. With 3 plates.

In this paper the development of *T. simiae* is described. The trypanosome belongs to the pecorum group. In this group development takes place in the intestinal tract, including the labial cavity of the proboscis, and afterwards the trypanosomes reach the hypopharynx, where they revert to the original blood or infective form.

Flies were found to become infective in 50 days at a temperature of 62° F. and in 20 days at 83° F.

By causing flies to salivate upon coverglasses the long narrow intestinal form of the organism was found, and there is no doubt that the fly has the power of regurgitating the contents of the proventriculus and intestine forwards into the labial cavity and probably into the blood stream.

Conclusions :—

" 1. That *T. simiae* can be transmitted from infected to healthy animals by the tsetse fly *G. morsitans.*

" 2. That *T. simiae* multiplies in the intestines and in the labial cavity of the proboscis of the fly. Here only developmental forms are found, never infective forms.

" 3. That *T. simiae* growing in the intestines of the " fly " has no specific characters by which it can be distinguished from other species of pathogenic trypanosomes found in tsetse flies.

" 4. That the final stage of the development takes place in the hypopharynx, wherein the infective form of the parasite, similar in shape to the trypanosome found in the blood of infected animals, is produced.

" 5. That the flies do not become infected until about 20 days after their first infected feed."

(16) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **Trypanosome Diseases of Domestic Animals in Nyasaland. III.** *Trypanosoma pecorum.—Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 1–26.

This trypanosome has been found in cattle, wild game, and wild flies in the neighbourhood of Kasu, and it is one of the most important trypanosomes of domestic animals in Central Africa, since it affects horses, cattle, goats, sheep, pigs, and dogs. The morphology of the trypanosome has already been dealt with. The bulk of this paper is made up of tables of measurement of the trypanosome in various animals and charts constructed upon these. A comparison of the charts constructed upon the measurements of the parasite occurring in domestic cattle, wild game and wild *G. morsitans* shews that they are very similar. The measurements were taken from the parasites present in the blood of a number of different animals.

The cattle strain of the organism is fatal to goats in 30 to 40 days, but death does not appear to be the invariable result.

Dogs are certainly killed within 30 days. Guinea-pigs and white rats appear to offer an absolute resistance to infection.

The wild game strain produces the same effect upon the goat as the domestic cattle strain. The monkey offers a considerable resistance. Only three out of eleven monkeys died of the infection, the remainder never shewing trypanosomes at all. In these three animals the period of incubation varied from 9 to 27 days, and the duration of the disease from 88 to 236 days.

Nine goats and nine dogs were inoculated with the wild game strain, and while all the goats became infected, none of the dogs contracted the disease. Of nine rats inoculated with this strain four remained healthy and five died in about 30 days.

Experiments with the wild fly strain had the following results: A single ox sent into the " fly " country contracted a double infection of *T. pecorum* and *T. caprae*, and died in 140 days.

Flies brought up from the " low-country " were as a rule fed upon a goat, a monkey, and a dog. As the flies were often infected with several species of trypanosome, the result in many cases was one of mixed infection. In 50 experiments with goats, 10 were pure infections with *T. pecorum.* As *T. pecorum* is the most rapidly fatal trypanosome for the goat among those occurring in the district, it may be assumed that it was mainly responsible for death in the 28 cases in which the infection was mixed.

In eight feeding experiments with wild *G. morsitans* carried out with pigs, only two shewed a pure *pecorum* infection.

Only six monkeys out of 28 became infected with this strain.

The dog is about as susceptible as the goat, and death usually takes place in, on an average, 41 days.

The carrier of the infection is *G. morsitans*. The percentage of infected flies was found to be 0·46. This is given as the minimum, and it is said that the real proportion is probably about three or four times as great.

It is also stated that given an outbreak in a herd there is some evidence to shew that *Tabanidae*, *Haematopota*, and other biting flies may act as mechanical carriers. The evidence that Stomoxys plays a similar rôle is said to be unsatisfactory.

(17) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. **The Trypanosome causing Disease in Man in Nyasaland.—Susceptibility of Animals to the Human Strain.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 35–45.

The bulk of this paper is made up of tables shewing the results of experimental inoculation of different species of animals with trypanosomes derived from five human sources.

Ox. The trypanosome is not so deadly as *T. pecorum*. Of 13 animals inoculated only one died, after an illness lasting 134 days, four became infected, and the remainder proved refractory. The recovered animals are in good condition, presenting a contrast with animals recovered from *pecorum* infection.

Goat. Twenty-two animals were inoculated and all died. The duration of the disease varied from 19 to 72 days. One animal shewed swelling of the face, but none developed any opacity of the cornea.

Sheep. The infection runs about the same course in the sheep as in the goat, and the same fatal result is obtained. Of seven sheep inoculated three shewed marked swelling of the face.

Baboon. One was inoculated and proved refractory.

Monkeys. Twenty monkeys died in from 10 to 51 days. Trypanosomes were always present in their blood and were often very numerous. There was no oedema of the face, and no corneal opacity was observed.

Dog. Of 25 dogs inoculated all died in from 14 to 78 days. In eight of the animals there was oedema of the face and opacity of the cornea.

Rabbits. Seven died in from 15 to 42 days. The clinical picture of an infected rabbit is said to be exactly like that of one suffering from infection with nagana. There is swelling of the eyes, the face puffs up, and sores break out around the eyes and nose. The eyes become closed up and there is a purulent discharge from the nose. The ears become thickened and covered with sores.

Guinea-pig. These animals are more refractory than rabbits, and often require to be re-inoculated before they take the disease. Fifteen were used, and they died in from 12 to 114 days.

Rat. Twenty-one were inoculated and all died in from 13 to 93 days.

Among the conclusions drawn is the following :—

"It is not satisfactorily proved yet to what species this trypanosome belongs, but the Commission at present leans to the opinion that it is *T. brucei* (Plimmer and Bradford)."

(18) Duke (H. L.). **Some Trypanosomes recovered from Wild Game in Western Uganda.**—*Rept. of the Sleeping Sickness Commission of the Royal Society.* 1913. No. 14. pp. 37–59. With 4 plates and 1 map.

The tour of investigation dealt with in this paper was undertaken with the object of obtaining information regarding the part played by wild game in the spread of trypanosomiasis of human beings and domestic animals.

The area covered is divided roughly into four areas as follows :—

1. The north-west portion of Ankole.
2. Parts of the Toro Province from the northern bank of the Kazinga Channel to the Mahokya and Hima Rivers.
3. The Southern Toro Game Reserve, extending from the northern end of Lake George northwards nearly to Fort Portal.
4. The Semliki valley north of the Mboga road.

The characteristic topographical features and predominant game species of each of these districts are dealt with in some detail. A series of wild animals shot in districts where tsetse are not known to occur served as controls.

Blood from freshly killed animals was defibrinated and used for the inoculation of goats, this species being selected in order to include as many species of trypanosomes as possible. At the same time smears were taken for staining and fresh preparations were examined. The goats used were purchased in tsetse-free districts and were examined daily before use. No evidence of natural infection was found.

It was found impossible to set aside a goat for each species of game examined owing to the distances covered and the difficulties of transport.

Full details of every goat inoculated are given and it may be gathered that the following trypanosomes, or trypanosomes closely resembling them, were found :—*T. vivax*, *T. pecorum*, *T. uniforme*, a trypanosome very suggestive of *T. gambiense*, *T. nanum*, and a trypanosome belonging to the *brucei-pecaudi-gambiense* group.

Trypanosomes were found in the blood of one antelope only out of 39 animals of different kinds shot in districts known to be free of tsetse, but it is said that possibly this animal may at some time have reached the fly zone on Lake Victoria.

Of the 52 animals shot in the tsetse districts 10 were found to be infected with trypanosomes, while only one of those shot in the tsetse-free districts was found to be infected. Since tabanids, Haematopota, Muscidae, Chrysops, etc., are common to both districts, there can be no doubt regarding the significance of Glossina as a carrier of trypanosomes.

Details are given of a number of investigations carried out with wild Glossina.

Conclusions :—

"1. A considerable portion of the wild game in the fly districts of the Western Province of the Uganda Protectorate is infected with trypanosomiasis.

"2. Certain of these trypanosomes have suspicious resemblance to the human trypanosomes, *T. gambiense* and *T. rhodesiense*. Others are known to be exceedingly pathogenic to domestic animals.

"3. The tsetse of these parts also contain flagellates which it is highly probable are derived from wild animals.

"4. The population of the fly districts is scanty, and the greater part has recently been moved to fly-free parts.

"5. It is reasonable to hope that, as regards the spread of human trypanosomiasis, the removal of the people from the infected districts will suffice, and this measure will simultaneously prevent native cattle being exposed to the fly bite. The majority of the fly area is practically uninhabited country.

"6. The alternative of destroying the game, and so of abolishing what is doubtless a permanent trypanosome reservoir, would be a gigantic and almost impossible undertaking in this region. In considering such a proposal elephant must, of course, be included, as must also hippo, situtunga, bush-pig and hyaena, all of which are difficult to eradicate. The scarcity of people is a serious objection to such a course, as is the difficult nature of the country. It would be well to await the trial of this expedient under more favourable conditions before undertaking so drastic a measure under severe natural handicaps.

"7. It would appear inadvisable to take any measures to protect the existing game and thereby encourage an increase in their numbers. On the other hand, it is inadvisable to permit natives to hunt in the fly districts. The ideal arrangement would be to make the fly districts prohibited areas, and in the region under consideration this is feasible to a far greater extent than would be the case in other parts of the Protectorate.

"Special attention must be directed to the Mahokya district in order to stamp out *G. pallidipes* from the immediate neighbourhood of the main road."

(19) Battaglia (M.). **Einige durch Trypanosomiasis Dromedarii erzeugte Läsionen.** [Lesions in the Dromedary caused by Trypanosomes.]—*Centralbl. f. Bakt.* 1. Abt. Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 182–184.

The author claims to have established the fact that this trypanosome multiplies by schizogony and sporogony. The parasite was obtained from Pricolo, who found it in a camel.

A rabbit was scarified with all possible aseptic precautions upon the prepuce with a hollow needle containing blood rich in trypanosomes. On the 4th day there was a hard, oedematous area at the seat of scarification, and by the 8th day there was scab-formation followed by ulceration and a hard granuloma. On the second day after scarification there were present in the blood intra- and extraglobular amoeboid forms of the parasite. On the 8th day, when true trypanosome forms were scantily present in the blood, rounded and pear-shaped forms were numerously present. Trypanosome forms were observed in large numbers in the lesions of the genital organs. There was oedema of the scrotum and orchitis.

In rabbits infection with this trypanosome runs a peculiar course. Infection occurs in whatever manner the animals are inoculated. During the first three days trypanosome forms are scantily present in the blood and after this they disappear although the blood remains infective. The animals gradually lose condition and die in from seven to eight months.

The local lesion of the genital organs is not developed if the inoculation is made at some other part of the body.

Rabbits and dogs sometimes shew keratitis.

(20) Favero (Francesco). **Su alcune Vie d'Introduzione del *Tripanosoma brucei*, considerate in Rapporto al Decorso dell'Infezione.** [On the Different Channels of Introduction of *Trypanosoma brucei*, considered in Relation to the Course of the Infection.]—*Clinica Veterinaria.* 1913. Nov. 30. Vol. 36. No. 22. pp. 996–1002, & Dec. 15. No. 23. pp. 1045–1054. With 1 chart.

The author, having set himself to discover what difference resulted from inoculating *Trypanosoma brucei* into different regions in dogs, found that the intensity of the resulting infection varied according to the seat of the injection, in the following order :—1, intra-thyroid, 2, intra-renal, 3, intravenous, 4, intra-urethral, 5, intra-testicular, 6, endo-peritoneal, 7, subcutaneous, 8, intra-medullary, 9, intra-splenic, and 10, into the anterior chamber of the eye. The results are exhibited in tabular form. The aqueous humour of the eye seems to have a distinctly attenuating effect upon *Trypanosoma brucei*, to judge from the mildness of the resulting infection.

The greater part of the paper is occupied with a discussion of the views of various authorities, and there is a copious bibliography at the end.

(21) Goretti (G.). **Ricerche Sperimentali sul Nagana. III Comunicazione. Contributo allo Studio delle Alterazioni del Sistema nervoso centrale nell'Infezione sperimentale da Nagana (*Tripanosoma brucei*).** [Experimental Investigations regarding Nagana. III Communication. The Alterations in the Central Nervous System in Experimental Nagana (*T. brucei*).]—*Lo Sperimentale.* 1913. Nov. 13. Vol. 67. No. 5. pp. 527–564. With 2 plates.

The author's conclusions are as follows :—

In rabbits, guinea-pigs and dogs experimentally infected with *Trypanosoma brucei* (nagana) serious lesions are found in the central nervous system.

1. Marked chromatolysis of the cellular elements in general.

2. Moderate infiltration with plasma cells and lymphocytes in the membranes and around the capillaries of the central nervous system, similar cells being found free in the lumen of the vessels. Also a moderate scattering of " Stabchenzellen " in the nervous tissues, particularly in the case of dogs.

3. Diffuse lesions of the myeline fibres of the brain, some of the tracts of the cord, the bulb, pons, mesencephalon and of the roots of the spinal and cranial nerves. These alterations can be demonstrated by the methods of Donaggio and Marchi.

4. More advanced bilateral lesions of the decussating pyramidal tracts may be demonstrable by Weigert's method, and the posterior roots and posterior spinal tracts may also be involved.

5. A slight proliferation of the neuroglia.

6. The lesions are in part of a secondary nature and probably due to toxic products liberated by the trypanosomes. Such products have already been shown to have an injurious effect upon the central nervous system.

(22) Paparcone (E.). **Ricerche Sperimentali sul Nagana. IV Comunicazione. Lesioni oculari per Infezione generale da *Trypanosoma brucei*.** [Experimental Investigations regarding Nagana. IV Communication. Ocular Lesions in General Infection with *T. brucei*.]—*Lo Sperimentale.* 1913. Dec. 17. Vol. 67. No. 6. pp. 933–942. With 1 plate.

The experiments given in this paper were carried out with a very

virulent strain of the trypanosome, mice dying in three days after intraperitoneal inoculation. It was found that in mice and rats death occurred in so short a time that no ocular lesions visible to the naked eye were produced. Lesions were found in rabbits and dogs, which offered more resistance to the infection and consequently survived for a longer period after inoculation. In from a week to a fortnight these animals showed swelling of the eyelids and adjacent tissues and a scabby condition of the edges of the lids. There was also a more or less intense conjunctivitis with a variable amount of muco-purulent secretion. The infected rabbits and dogs, and particularly the latter, showed a parenchymatous keratitis of the cornea associated with iritis.

The conclusions drawn are :—

1. In dogs and rabbits experimentally infected with *T. brucei* lesions may be observed involving the tissues of the eye. Blepharitis, conjunctivitis, intense diffuse parenchymatous keratitis, irido-cyclitis, choroiditis, etc., may be seen.
2. The trypanosomes may be found in the conjunctival secretion and in the aqueous humour (in stained preparations and by animal inoculation).
3. They are demonstrable in the cornea in the earliest stages when it is still transparent and when the keratitis is intense. The interstitial lesions are due to the multiplication of the parasites in the parenchyma of the cornea and to their toxic products. It has been found possible to produce parenchymatous keratitis with extracts of trypanosomes.
4. As the aqueous humour contains trypanosomes, whatever the method of infection, so animals can be infected by inoculation into the anterior chamber of the eye.

(23) Bovone (E.) & Maja (A.). **Nota su di un Tripanosoma del Bovini del Katanga.** [A Trypanosome of Bovines in Katanga.]—*Giorn. di Med. Vet.* 1913. Oct. 25. Vol. 62. No. 43. pp. 1033–1035.

The authors describe the occurrence of a large trypanosome in the blood of seven bovines on the Esschen Plateau. In fresh blood the parasite was exceedingly active, the movement involving translation. The nucleus was visible and appeared to be about the size of a red blood corpuscle, and the posterior portion of the body shewed a number of large granules. Although the centrosome could not be made out, it appeared to be placed near to the nucleus, and the undulating membrane and flagellum took origin from that situation. The parasite was very scantily present in the blood.

Only one stained preparation was available for examination and in this the parasite measured 60 microns in length by 5 in width. Both ends tapered to a marked degree. The authors think that the organism was *T. ingens*.

(24) Ferber (F.). **Beiträge zur Biologie der nur auf kulturellem Wege nachweisbaren Flagellaten des Rinderblutes.** [The Biology of the Culturally Demonstrable Flagellates of Ox Blood.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. Dec. 12. Vol. 76. No. 2. pp. 193–207,

Multiplication of the parasites is inhibited either partially or completely at 37° C., and at 53° C. the parasites gradually die. Temperatures of 50° C. and lower for a period of 24 hours do not injure the vitality of the parasite.

The flagellate multiplies in broth prepared from various kinds of meat, but not in defibrinated blood or salt solution.

The parasite multiplies on faintly alkaline agar and on blood agar, and in blood broth whether the blood used for the medium is taken from an animal that has been infected or not.

In no stage of development can the flagellates pass Berkefeld filters.

It was found to be impossible to infect animals with cultures, as indicated by the non-appearance of trypanosomes in the blood and the absence of flagellates in cultures.

(25) Blacklock (B.) & Yorke (W.). *Trypanosoma vivax* **in Rabbits.** —*Ann. Trop. Med. & Parasit.* 1913. Dec. Vol. 7. No. 4. pp. 563–568.

The strain of *T. vivax* used in this series of experiments was that isolated by the authors from a horse from the Gambia (see this *Bulletin*, Vol. 1. No. 2. Abstr. No. 121. pp. 76–77). After the isolation of the parasite the strain was preserved by passage through goats, the number of passages up to the date of writing being 39. During this period there was observed no exaltation of virulence for the goat. The average duration of the disease during the whole period has been 30 days.

A number of attempts were made to infect rabbits from the goats of this series, but the inoculations failed or resulted in a transitory infection from which the animals recovered. From the 38th goat of the series, however, rabbits were successfully infected by intraperitoneal inoculation.

The period of incubation was 5 to 8 days, and of the four rabbits used two died, in 17 and 34 days and the other two recovered.

From these rabbits the strain has been carried on in others over a period of more than three months to the eighth generation. Goats have been successfully inoculated from rabbits. The strain has not proved to be invariably pathogenic for the rabbit, and many of them appear to have recovered, but the majority have certainly become infected.

Examination of the strain after passage through six generations in the rabbit shewed that the parasite as a rule did not exhibit the same degree of activity as in the goat, but there were no discoverable alterations of morphology.

(26) Mesnil (F.). **Sur le Nagana de l'Ouganda.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 685–689.

After referring briefly to the literature regarding the identity or otherwise of *T. brucei* Plimmer and Bradford and *T. brucei* (Uganda), the author gives details of some experiments carried out with the idea of throwing further light upon the question.

Three goats, two of which had been used for experimentation with other trypanosomes, were inoculated with the Uganda strain, the "ferox" (Ehrlich) nagana strain and the Zululand strain. The first and last of these died as a result of the inoculations. The goat inoculated with the "ferox" strain survived and apparently recovered, since its blood was non-infective for a dog. It received a second inoculation with the same strain and became reinfected. Before it had recovered from the second inoculation it was inoculated with

the Zululand strain of nagana. About six months after this inoculation its blood was negative when tested by the inoculation of dogs. After a further interval of six months it was again inoculated with the Zululand strain and failed to become infected, as shewn by the experimental inoculation of mice.

The author concludes that at this date the goat was immune to the Zululand strain.

Two months later it was inoculated with the Uganda strain, and succumbed to the infection after an interval of two months.

From this the author concludes that the Zululand strain is different from the Uganda strain, and this view is supported by the results obtained in some passive immunity experiments which are briefly referred to.

(27) Macfie (J. W. Scott) & Johnston (J. E. L.). **A Case of Equine Trypanosomiasis characterised by the Occurrence of Posterior Nuclear Forms.**—*Jl. Trop. Med. & Hyg.* 1913. Nov. 15. Vol. 16. No. 22. pp. 348–349. With 1 text figure.

The trypanosomes described in this short note were found in films of blood taken from a horse at Accra. Long slender and short stumpy forms were met with and in many cases the tropho-nucleus was situated in the posterior half of the body. In no instance was a trypanosome observed in which the tropho-nucleus was actually posterior to the kineto-nucleus, although in many it was touching it.

Following the procedure described by Blacklock the authors found that the nucleus was definitely posterior in 4·8 per cent. of all trypanosomes, except dividing forms, present.

As it was impossible to carry out any inoculation experiments the authors are unable to identify the parasite with certainty, but they state that a parasite with the same morphology is responsible for the death of a large number of horses in Northern Nigeria every year. Several specimens were identified by Bruce as *T. brucei*.

The author points out that, if *T. brucei* (*pecaudi*) is identical with *T. rhodesiense*, one would expect to find cases of human trypanosomiasis due to *T. rhodesiense* in places where *T. brucei* is common among the domesticated animals. This is not the case in Nigeria. Sleeping sickness there does not present the acute features observed in cases in Rhodesia. The disease is endemic, but by no means fatal.

One of the authors has recently studied the trypanosome from a case of sleeping sickness in Southern Nigeria, and it is stated that neither in its morphology, measurements, nor in its animal reactions does it resemble *T. brucei* (*pecaudi*) or *T. rhodesiense* (see below p. 25).

(28) Neiva (A.). **Multiplicaçao no Vinchuca (*Triatoma infestans* Klug) do Trypanosomo do Mal de Cadeiras.** [The Multiplication of the Trypanosome of Mal de Caderas in the Vinchuca.]—*Brazil Medico.* 1913. Sept. 15. Vol. 27. No. 35. pp. 366–367.

The author has been unable to find a correspondence in distribution between the capybara and mal de caderas, although it was suggested by Elmassian and Migone that that animal was the reservoir for the trypanosome. He has been able to infect the vinchuca experimentally

and has found that its faeces are infective for guinea-pigs when placed upon the conjunctiva. The period of incubation was 10 to 15 days.

It is suggested that flies of the genus Chrysops are more probably the transmitting agents than *Stomoxys calcitrans*, as suggested by SIVORI and LÉCLER.

(29) BLACKLOCK (B.) & YORKE (W.). **The Trypanosomes causing Dourine (Mal de Coït or Beschälseuche).**—*Proc. Roy. Soc.* 1913. Oct. 16. Series B. Vol. 87. No. B. 593. pp. 89–96. With 1 plate.

In this paper the authors record the results of their examinations of three strains of trypanosomes said to be the trypanosome of Dourine. The first of these was obtained from the Kaiserliches Gesundheitsamt, Berlin, and is said to have come originally from Algeria, the second from EHRLICH, the origin of which is unknown, and the third was the strain responsible for the outbreak of dourine in Eastern Prussia in 1905.

The biometrical method was adopted.

The authors find that the second and third strains closely resemble each other morphologically, while the first presents marked differences. The second and third belong to the group of trypanosomes in which all individuals have a free flagellum, while the morphology of the first strain does not enable them to distinguish it from *T. rhodesiense* or *T. brucei* Uganda.

They are conducting experiments to ascertain whether the strains are still capable of setting up the typical disease in equines. For the present they propose the name *T. equi* for the *rhodesiense*-like organism.

(30) BAUCHE (J.) & BERNARD (P. N.). **Notes sur le Surra d'Indo-Chine à Hué.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 690–693.

The natural disease.—Equine trypanosomiasis in Annam has been differentiated from the surra of India by LAVERAN and MESNIL, by whom the causal trypanosome was named *T. annamense*. The disease exists in Annam as an enzootic among horses, cattle, buffaloes, and dogs. In a paper published by SCHEIN in 1907 the part played by cattle in forming the reservoir of the virus was emphasised.

The authors have examined the blood of 300 cattle at the slaughter-houses in apparent good health and have discovered trypanosomes by direct observation on six occasions. Eighty-nine buffaloes were examined with negative results. A single infected dog was found among 300 examined.

In two outbreaks which resulted in the death of 9 out of 48 and 100 out of 200, the horses were stabled near the cattle sheds. The batches of horses pastured near woods furnished the whole of those that became infected, while those that were pastured upon cleared land, going out only at night or on cool days when there was no sun, remained absolutely free from infection.

The average period of incubation was 11 days, and it was found possible to arrest an outbreak by taking daily temperatures, isolating

the animals shewing a febrile elevation and slaughtering them after a diagnosis by microscopic examination.

Experiments carried out with a variety of species of flies upon guinea-pigs failed.

Experimental inoculations.—It having been suggested by BALDREY that the pig might be the reservoir of surra, the authors examined the blood of about 2,000 pigs without discovering a single one infected. The trypanosome was found to be pathogenic for pigs, death taking place in from 10 to 75 days. Of a number of guinea-pigs inoculated from an infected dog the majority died in from three weeks to a month, and two monkeys died in 13 and 26 days.

In experimentally infected pigs the trypanosomes appeared in the peripheral blood in two to five days after intraperitoneal inoculation, and in from seven to eleven days after subcutaneous inoculation. The fever is intermittent and the appearance of trypanosomes in the blood coincides with the elevations of temperature. At the time of death the organisms are very numerous in the blood.

Clinically the disease is characterised simply by progressive emaciation, without any oedema, paralysis or lesions of the eyes.

At the post-mortem the spleen may be found to be three times the normal size.

(31) MOHLER (J. R.), EICHHORN (A.), & BUCK (J. M.). **The Diagnosis of Dourine by Complement-Fixation.**—*American Jl. Vet. Med.* 1913. Nov. Vol. 8. No. 11. pp. 581–587.

After trying a number of methods of obtaining antigen the authors adopted the plan of using an emulsion of the spleen of rats made with salt solution. The trypanosome used as antigen was not *T. equiperdum*, but *T. evansi*. "As dourine is the only known trypanosome infection of horses existing in this country, the value of even a group reaction was immediately appreciated and attention was directed to the carrying out of this idea in our diagnostic work."

Excellent results are claimed for the method.

(32) BRUCE (David), HARVEY (D.), HAMERTON (A. E.), & Lady BRUCE. **Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland.—The Mzimba Strain.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 26–35. With 3 plates.

This paper deals with the question whether the trypanosome causing human disease in Nyasaland is restricted to the game and "fly" of the Proclaimed area or whether it extends north and south along the fly-belt. The trypanosome dealt with was found in the blood of a donkey at Mzimba about 100 miles north of the northern border of the Proclaimed area. Tables of measurements of the trypanosome in a number of different animals, and three plates illustrating the fixed and stained organism are given. The conclusions arrived at are as follows:—

"1. The trypanosome of the Mzimba strain is the same species as that occurring in the wild game inhabiting the Proclaimed area, Nyasaland.

"2. It has already been concluded that this species is *T. brucei* vel *rhodesiense*.

"3. Hence it would appear that wild *G. morsitans* occurring in a district 100 miles north of the Proclaimed area are infected with the trypanosome which causes the human trypanosome disease of Nyasaland."

(33) Eckard (B.). **Uebertragung des *Trypanosoma rhodesiense* durch die *Glossina palpalis*.** [The Transmission of *T. rhodesiense* by *G. palpalis*.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 73–76.

In this paper the author gives a chronological list of the more important work that has been done in connection with the transmission of trypanosomes by tsetse flies and draws the conclusion that given favourable conditions any known pathogenic trypanosome can develop in any species of Glossina. Further observations are necessary to decide whether any particular species of Glossina is especially concerned in the transmission of trypanosomiasis.

The author has had the opportunity of carrying out some experiments in the transmission of *T. rhodesiense* derived from a case of sleeping sickness in Nyasaland with *G. palpalis*.

Four hundred and seventy-six laboratory-bred *G. palpalis* were fed in series on infected guinea-pigs and after a period of starvation of two days were fed upon healthy goats and monkeys. Some of these animals were found to be infected on the 32nd day.

It was found that 2·5 per cent. of the total number of flies were infective, and developmental forms were found in nine flies which had died by the 10th day.

Three of the infective flies were used for the purpose of determining the infectivity of the trypanosomes in the various organs. After they had been fed upon healthy animals for two days they were killed by chloroform and their salivary glands, proventriculus and intestines were used for the subcutaneous inoculation of healthy monkeys. All the animals were found to be infected on the 5th day.

These results are in agreement with those obtained by Kinghorn and Yorke, but in striking contrast with those obtained by Kleine, Eckard, and Miss Robertson.

The possibility is considered that injury to the salivary glands might have been responsible for the contamination of the other organs, but the author is of the opinion that the number of experiments negatives this possibility.

It is further suggested that the ages of the flies might be a determining factor.

In the author's experiments the flies were 40 days old and in those of Kleine and Eckard they were from 50 to 60 days old. With the object of obtaining some evidence on this point a fly was kept until the 54th day when it was dissected, its organs being used for the inoculation of monkeys. In this case only the one inoculated from the salivary glands became infected. Examination of the fly shewed that numerous trypanosomes were present in the intestine, and the author concludes from this that development in the intestine gradually declines, the virulent parasites making their way to the salivary glands.

(34) Kleine (F. K.) & Eckard (B.). **Ueber die Bedeutung der Haustiere und des Wildes für die Verbreitung der Schlafkrankheit.** [The Importance of Domesticated and Wild Animals in the spread of Sleeping Sickness.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. July 17. Vol. 75. No. 1. pp. 118–122.

Experiments were carried out in which infective *G. palpalis* were fed upon healthy sheep, goats and monkeys. Of 13 instances in which sheep and goats were used the result was negative in nine, while in the monkeys (number not stated) the result was invariably positive.

The authors were unable to infect *G. palpalis* on three out of seven animals in whose blood *T. gambiense* was to be found.

Two goats which had been infected in September 1910 recovered, as shewn by experimental inoculation and fly experiments. The animals failed to become infected again when re-inoculated subsequently.

Five oxen, 55 goats and 25 sheep from districts in which sleeping sickness was widely spread were examined and *T. gambiense* was found in one ox, one goat and one sheep.

The authors failed to find *T. gambiense* in any of the game examined.

(35) Taute (M.). **Untersuchungen über die Bedeutung des Grosswildes und der Haustiere für die Verbreitung der Schlafkrankheit.** [The Significance of Big Game and Domesticated Animals in the Spread of Sleeping Sickness.]—*Arbeit. a. d. Kaiserl. Gesundheitsamt.* 1913. Aug. Vol. 45. No. 1. pp. 102–112. With 1 plate.

These experiments were carried out at Lubimbinu in Portuguese Nyasaland. This place is itself fly-free, but is surrounded by a fly belt in which *G. morsitans* is plentiful. The population is free from trypanosomiasis, but the contrary is the case with domestic animals. Cattle and sheep are not found, goats and dogs only occasionally.

Thirty-seven wild animals were examined and trypanosomes were found in 20, either by direct examination or by experimental inoculations. Trypanosomes possessing the pathogenic range of *T. rhodesiense* were found in six of the inoculated monkeys and dogs. The remaining trypanosomes found belonged either to the *T. vivax* or *T. pecorum* groups.

Polymorphic trypanosomes shewing posterior nuclear forms were found in six out of ten animals upon which wild *G. morsitans* were fed. Seven dogs and a goat from the fly-belt were found to be infected with a trypanosome which was morphologically similar.

Experimentally infected dogs and goats died on an average in 36 and 16 days respectively, and shewed keratitis and oedema of the face.

The author states that if the trypanosome be in reality *T. rhodesiense*, about 16 per cent. of the game and domesticated animals are infected while the population remains free from infection.

To test this question of identity the author fed a number of laboratory-bred flies upon a monkey infected with the antelope strain. After a period of starvation for a day they were fed upon a series of goats, monkeys and dogs up to the 27th day. From the 28th to the 32nd day they were fed upon the author and from the 33rd to the 44th day upon another series of animals. The four animals upon which

the flies were fed from the 20th to the 27th day became infected, as did the three animals fed upon from the 33rd to the 44th day, but the author remained in good health.

A second experiment of a similar nature was carried out and with the same result.

In a third experiment the author was inoculated with 2 cc. of blood from a naturally infected dog but failed to become infected, while animals inoculated with the same blood all became infected and died.

Blood drawn from the author failed to infect a monkey and a number of dogs.

The author considers that the trypanosome of game and domesticated animals is *T. brucei*.

(36) Mello (U.). **Le *Trypanosoma gambiense* a-t-il une Affinité pour le Testicule?**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 583–588.

The experiments detailed in this paper were carried out to control the statement made by Uhlenhuth and Emmerich to the effect that in rabbits inoculated with *T. equiperdum* and *T. gambiense* the multiplication of the trypanosomes is far more advanced in the testicles than in the blood. This multiplication takes place, according to these authors, in both testicles even when only one has been the seat of inoculation, and it occurs even when the animal has been inoculated by some other path.

Seven rats, five guinea-pigs, four rabbits, and a monkey were used, and the trypanosome employed was *T. gambiense*.

Rats. In rats the trypanosome first made its appearance in the blood, no matter in what manner the animal was inoculated. Parasites could be found in small numbers only in the testicle, even when that had been the seat of inoculation, and they were always more numerously present in the blood.

Guinea-pigs. Trypanosomes made a rapid appearance in the testicles in those cases only in which that had been the seat of inoculation. After intra-testicular inoculation the parasites may be discoverable in the other testicle before they can be found in the blood.

Monkey. The appearance of trypanosomes in the testicle did not precede their appearance in the blood.

Rabbits. The experiments carried out with these animals at first offer the most support to the view expressed by Uhlenhuth and Emmerich, since on several occasions trypanosomes were fairly numerous in the testicles while still scanty in the blood (as is the rule in rabbit trypanosomiases). The author does not think that this is conclusive. He was informed by Laveran that he had frequently observed that trypanosomes multiply more rapidly in oedematous liquid when that is present in any part of the body than in the blood, and it was in the oedema resulting from the inoculation or from repeated punctures that the trypanosomes were found. Further, when a pipette is introduced into the testicle the liquid obtained is frequently from the sheath of the testicle and not from the substance of the organ itself. It is easy to conceive that trypanosomes might be more numerous in this than in the blood after intraperitoneal inoculation.

(37) Macfie (J. W. Scott). **On the Morphology of the Trypanosome (*T. nigeriense*, n. sp.) from a Case of Sleeping Sickness from Eket, Southern Nigeria.**—*Ann. Trop. Med. & Parasit.* 1913. Aug. Vol. 7. No. 3A. pp. 339–356. With 1 plate.

In the unstained state it can be observed that some of the parasites are long and slender and others short and stout. The former execute rapid vibratory and translatory movements. The translatory movement is spasmodic.

In preparations fixed with alcohol or osmic acid and stained with Giemsa the longest trypanosome found measured 32 microns and the shortest 8 microns. The breadth varies from 1 to 2·5 microns, and the short individuals are generally the stoutest. The trypanosome is polymorphic. Two long slender forms have been observed, one in which the micronucleus is terminal and the other in which it is situated about 1 micron from the posterior extremity, the extremity of the body being drawn out into a blunt "snout." In some parasites the nucleus shews a clear area in the centre.

The trypanosome appears to be feebly pathogenic for laboratory animals. The original guinea-pig in which the author received the strain had at the time of writing been alive 124 days since inoculation and was still apparently well. Other animal inoculations made so far are as follows:—Five guinea-pigs have not shewn trypanosomes and one of these has been inoculated 56 days. Three mice out of seven have shewn very small numbers of trypanosomes in from four to eight days after inoculation. Two goats and two dogs have never shewn trypanosomes, and in one monkey they appeared in small numbers on the 10th day, but have up to the time of writing (22 days after inoculation) always been scanty.

(38) Macfie (J. W. Scott). **Preliminary Note on the Development of a Human Trypanosome in the Gut of *Stomoxys nigra*.**—*Ann. Trop. Med. & Parasit.* 1913. Nov. Vol. 7. No. 3B. pp. 359–361. With 1 text-fig.

In this short note the author records the results obtained in a small number of experiments which circumstances compelled him to interrupt.

A number of *Stomoxys nigra* were fed upon a guinea-pig infected with a trypanosome from a case of sleeping sickness from Eket in Southern Nigeria. Thirteen flies were dissected from one to six days after being fed. In six of them flagellates were found in the mid-gut. Twelve flies caught in the laboratory which had not been fed upon the guinea-pig were dissected, but in none were any flagellates found.

Further experiments were made with flies bred in the laboratory. Two bred flies were fed upon the infected guinea-pig the day after hatching, and three days later herpetomonas were found in the mid-gut of each. There were none in the salivary glands or the proboscis. As controls two bred flies which had not been fed upon the guinea-pig were dissected and no flagellates were found.

(39) Laveran (A.). **Au Sujet des Infections des Souris par le *Trypanosoma duttoni*.** [The Infection of Mice with *T. duttoni*.]—*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 626–627.

The author received six mice inoculated with the trypanosome from Senegal. The species of mouse was *Mus maurus*. They were all shewing trypanosomes in their blood at the time of arrival. Four of these mice were killed for the inoculation of white mice, and the infection was followed by periodical examinations in the other two.

The author was unaware how long the mice had been infected before they came into his possession, but after their arrival they lived for 22 and 26 months and apparently died of old age. Trypanosomes could always be found in their blood in larger or smaller numbers.

Two of the white mice inoculated appeared to make complete recoveries, trypanosomes disappearing from their blood after seven and four and a half months respectively.

It was shewn by inoculation that the progeny of infected mice possessed no immunity.

(40) Laveran (A.). **Trypanotoxines. Essais d'Immunisation contre les Trypanosomes.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 693–698.

The author has repeated with slight modifications the experiments of Schilling and Rondoni regarding the production of trypanotoxines in liquids containing dead trypanosomes, when these are heated for certain periods at 37° C., and the immunising effects of sub-toxic doses of such materials. He has failed to produce either the toxic or the immunising effect, and concludes with regard to the latter that when the results are not entirely negative they are partial and inconstant.

(41) Levaditi (C.) & Mutermilch (St.). **Recherches sur la Production des Anticorps chez les Animaux Trypanosomiés et traités par le Salvarsan.**—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 699–704.

The authors' experiments in connection with this subject, which have not been previously published, were carried out in 1911, and the reason for their publication lies in the publication of the results obtained by Margulies, and Ellis and Swift.

They find that if "606" be administered intraperitoneally to rats infected with nagana, on the third day of infection, when the trypanosomes are numerous in the blood, the serum becomes trypanocidal two hours later. The longer the period elapsing between the disappearance of the trypanosomes from the blood and the taking of the sample of serum the less is its trypanocidal power. This power disappears completely by the 30th hour. The fact that heating the serum to 56° C. does not destroy its trypanocidal power indicates that it is not due to trypanolytic properties of the serum, but to the presence of "606" in it.

On the other hand evidence is furnished by the experiments that, in spite of the richness of the blood in trypanosomes and the considerable quantity of antigen liberated by the action of the drug, antibodies do not make their appearance until the 5th day after inoculation.

(42) Schilling (C.) & Rondoni (P.). **Tossine Tripanosomiche e Immunità di fronte ai Tripanosomi.** [Trypano-toxins and Immunity against Trypanosomes.]—*Lo Sperimentale.* 1913. Nov. 13. Vol. 67. No. 5. pp. 595–613.

In this paper the authors record the toxic effects of inoculating mice with suspensions of trypanosomes kept at 37° C. for variable periods.

They also found that emulsions of trypanosomes heated to 37° C. for certain periods were capable of conferring a degree of immunity.

(43) Johnston (J. E. L.) & Macfie (J. W. Scott). **Observations on the Action on Trypanosomes of certain Drugs and of *Staphylococcus pyogenes*.**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 207–212.

This paper contains the records of a few investigations carried out with bromine, iodine, and osmic acid and also *Staphylococcus pyogenes*. The experiments were made *in vitro* and *in vivo*, but the results were almost entirely negative in character.

A few initial experiments were made to determine the effects of dilute solutions of iodine, bromine, and osmic acid upon trypanosomes in cover-slip preparations. The results obtained were very inconclusive.

In the experiments carried out on living animals, sheep infected with *T. vivax* and rats infected with *T. lewisi* were used. In the case of the sheep the injections were given intravenously, and in the rats subcutaneously. The solutions used were:—Tincture of iodine in distilled water in the proportion of 7 minims to the drachm, 2·5 per cent. bromine in the same proportion, and 2 per cent. osmic acid, 12 minims to the drachm. The rats received doses varying from 5 to 20 minims, and the sheep, of which only one appears to have been subjected to experiment, was given one drachm of pure tincture of iodine intravenously. The drugs appeared to have a disturbing effect not only on the trypanosomes but also on the hosts. The authors consider that trypanophagocytosis occurs and that large numbers of trypanosomes may be rapidly destroyed by this means.

The injection of staphylococcus vaccines into rats infected with *T. lewisi* appeared to be without effect.

(44) Macfie (J. W. Scott) & Johnston (J. E. L.). **Auto-Erythrophagocytosis as an Aid to the Diagnosis of Trypanosomiasis. (Preliminary Communication.)**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 212–215.

The authors have observed the ingestion of red cells by leucocytes to which attention was drawn by Connal and others. They have made observations using *T. lewisi*, a trypanosome resembling *T. gambiense* from a case of sleeping sickness, and *T. duttoni*. They divide their cases into the following three groups:—

1. Those in which leucocytes containing red cells were present in blood which subsequently contained trypanosomes.

2. Those in which leucocytes containing red cells and trypanosomes were present at the same time.

3. Those in which leucocytes containing red cells were found after the disappearance of trypanosomes.

The ratio of cells containing red corpuscles to other leucocytes is seldom higher than 1 per cent.

The suggestion is put forward that erythrophagocytosis may be a material aid in the diagnosis of trypanosomiasis.

(45) Kolle (W.), Hartoch (O.), Rothermundt (M.), & Schürmann (W.). **Chemotherapeutische Experimentalstudien bei Trypanosomeninfektionen.** [Experimental Chemotherapeutic Investigations in connection with Trypanosome Infections.]—*Zeitschr. f. Immunitäts. u. experim. Therapie.* 1913. Aug. 5. Vol. 19. No. 1. pp. 66–97.

This paper contains a repetition of results previously published (see References 194 and 556, Vol. 1, this *Bulletin*) together with a description of some further experiments with antimony trioxide.

Attention is drawn to the necessity of a thorough study of the actions of various compounds of antimony, as in the past it has been compared too closely with arsenic .

Experiments were carried out using metallic antimony reduced to a fine powder and suspended in oil. This material was injected intramuscularly into mice infected with nagana.

The strain of trypanosomes used was invariably fatal in five days, and the drug was administered on the 2nd or 3rd day.

It was found that the toxic dose was 5 mg. per 10 g. body weight, and that 1 mg. caused a disappearance of trypanosomes with the utmost certainty, and no relapses occurred. Larger doses invariably produced poisoning.

Numerous organic and inorganic compounds of antimony were tested with the object of finding out the connection between their composition and their therapeutic effects. Pentavalent compounds were found to be by far less toxic than the trivalent but they were practically without therapeutic effect in trypanosome infections. The trivalent compounds were both toxic and trypanocidal, particularly the trioxide, to which the authors give the name "Trixidin."

Experiments showed that a dose of 120 mg. per 10 g. body weight produced neither acute nor chronic toxic effects, nor did it produce any changes in the blood or organs.

It was observed that the intramuscular injections of large doses of "Trixidin" into rabbits, dogs, and apes was liable to lead to abscess formation. Experiments are being carried out with the object of avoiding this by distributing the injections over different parts of the body.

"Trixidin" is insoluble in water and is slowly absorbed.

While mice withstand the injection of 100 mg. per 10 g. body weight, one hundredth part of this quantity is effective in the treatment of experimental nagana in them.

The injection of sufficiently large doses of "Trixidin" protected mice in the majority of cases when inoculated as much as 16 days after with nagana and up to the time of writing this immunity had lasted 91 days.

A list is included in the paper shewing a number of compounds of various metals which were tried and which were found to be either useless, or, though useful, impracticable in application.

The authors have been able to effect cures with drugs, which when injected either lead to intoxication or permit of relapses, by applying them externally in the form of salves.

"Trixidin" was found to be ineffectual in the treatment of mice infected with the spirochaete of African relapsing fever and *Schizotrypanum cruzi*.

(46) Monfort (F.). **Essais de Traitement des Trypanosomiases expérimentales par l'Arsénophénylglycine.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 588-590.

The author's experiments have been carried out with adult mice inoculated with *T. gambiense*, *T. rhodesiense*, *T. dimorphon*, and *T. congolense*.

In the majority of cases the dose employed was 3 mg., but mice tolerate twice or three times this dose without shewing any symptoms. The drug was administered by intramuscular injection. Brief details are given of four series of experiments made with the trypanosomes mentioned and the results arrived at may be summarised as follows :—

In all, fourteen animals inoculated with the two human trypanosomes were treated and in no case was there a relapse, the animals being kept under observation up to 86 days in the case of the *gambiense*, and 64 days in the case of the *rhodesiense*.

Of five animals infected with *T. dimorphon* only one shewed a relapse during a period of 75 days.

Seven mice inoculated with *T. congolense* were put under treatment with doses of 3, 6, and 9 mg., but in no instance did the drug have any effect beyond a brief disappearance of the trypanosomes from the blood.

(47) Heckenroth (F.) & Blanchard (M.). **Le Néosalvarsan dans le Traitement de la Trypanosomiase humaine.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 591–512.

In this paper the authors publish the results obtained in the treatment of human trypanosomiasis with a single intravenous injection of neosalvarsan. In 16 cases the persons treated were in good condition and in the remainder in moderate or bad condition.

The drug was administered dissolved in distilled water in the proportions of 0·15 g. and 0·45 g. per 25 cc. The dose varied from 1 cg. per kilog. to 2·1 cg. per kilog. It was observed in some cases in which the dose was 1·5 cg. or over that fever, vomiting, and diarrhoea occurred some hours after.

The drug appears to cause a rapid disappearance of the trypanosomes from the blood, but acts with less certainty upon those in the lymphatic glands. Trypanosomes have been discovered by gland puncture from 1 to 7 days after the administration of 1·7 cg. per kilog. of the drug.

Of the 25 cases treated 4 have not yet been re-examined, 9 have remained without relapse after an average period of 4½ months, 2 died after 3 months and 1½ months without relapse, and in 10 cases there has been a relapse after an average period of 2½ months.

(48) NÄGLER (K.). **Experimentelle Studien über die Passage von *Schizotrypanum cruzi* Chagas durch einheimische Tiere. Teil I.** [The Passage of *Schizotrypanum cruzi* through Indigenous Animals.]—*Centralb. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol 71. No. 2/3. pp. 202–206. With 1 plate.

The author's conclusions are as follows :—

1. Mice, rats, guinea-pigs, rabbits, dogs, and cats are susceptible to infection with *Schizotrypanum cruzi*. It has not been found possible to transmit the parasite to canaries, lizards, and frogs.
2. The parasite is not transmitted hereditarily.
3. Infection experiments with insects failed.
4. The "male" and "female" forms described by CHAGAS as sexual individuals are vegetative forms.
5. No morphological differences are to be observed in the parasite obtained from mice, rats, and guinea-pigs.
6. In the peripheral blood, and even two hours after death, numerous divisions occur.

SPIROCHAETOSIS.

(49) MARCHOUX (E.) & COUVY (L.). **Argas et Spirochètes. Deuxième Partie. Le Virus chez l'Acarien.** [Argas and Spirochaetes. Second Part. The Virus in the Tick.]—*Ann. Inst. Pasteur.* 1913. August. Vol. 27. No. 8. pp. 620-643.

The authors recapitulate the facts which they claim to have established in the first portion of this paper (see this *Bulletin*, Vol. 1. No. 5. pp. 298–301), viz., (1) the granules found in the tick stand in no relationship to the spirochaete and therefore the method of preservation of infection and hereditary transmission must be sought elsewhere; (2) spirochaetes retain their virulence in the coelomic cavity of the tick as such, with the single modification of a decrease in thickness.

In the second portion of the paper the authors propose to shew that spirochaetes alone are responsible for the transmission of the infection.

Experiments are quoted shewing that the inoculation of material obtained by grinding up infected ticks sometimes produces infection but more usually confers immunity. It is further shewn that inoculation with a portion of an infected tick such as a salivary gland or an oviduct is also followed by immunity.

That this immunity is not due to antibodies formed in the tick was shewn by the fact that if the material was heated to 55° C. for five minutes the power to infect was destroyed, while the power to confer immunity remained. On the other hand if the heating was continued for 20 minutes immunity did not result. These results agree with those obtained when material known to contain spirochaetes is treated in exactly the same way. It was also shewn that the filtration of such material destroyed its power both of infecting and immunising.

Using WRIGHT'S method of estimating the number of spirochaetes present in a quantity of liquid, the authors have carried out a number of experiments having for their object the estimation of the number of spirochaetes required to confer immunity, and to produce infection. The bird selected for the experiments was the padda and the following results were arrived at. By intramuscular inoculation it was necessary

to inject 20,000 spirochaetes in order to set up infection. Immunity was conferred when the number of spirochaetes injected lay between 17,000 and 735. If a smaller dose was administered no effect of any kind was produced. When intravenous inoculation was resorted to it was found that 17,000 spirochaetes caused infection, 70 conferred immunity, and 17 produced no effect. Thirty spirochaetes introduced into a fowl's egg during incubation sufficed to set up infection. The figures given do not pretend to be absolutely exact, but the authors claim that, since they have been working with a single strain and their results have always been concordant, the figures obtained are sufficiently exact.

Marchoux and Couvy have been unable to find any coxal gland in argas and they believe that the so-called coxal fluid is in reality coelomic fluid which escapes by a process of rapid filtration. This, they believe, plays no part in the transmission of infection to the vertebrate host.

Although numerous dissections have been made, spirochaetes have been found in exceptional cases only in the salivary glands and then only in small numbers in individuals which have been starved for a fortnight. Examination of the excretory ducts of the salivary glands shewed that they contained considerable numbers of spirochaetes including numerous dividing forms. This was found to be the case even in ticks that had been starved for as long as two months. Further examinations shewed that after a meal the parasites had almost entirely disappeared from the excretory canal and that after an interval of from two to five days they were very numerous in the salivary glands, whence they passed to the excretory ducts.

It is said that a meal of non-infected blood causes a fresh multiplication of the parasite in the tick and fresh invasion of the excretory ducts. An infected tick which had become non-infective through starvation is said to have again become infective as a result of a meal of non-infected blood.

Two explanations of the transmission of the infection through the egg of the tick, which the authors claim to have proved, are given. The secretion of the cephalic glands which serves to cement the eggs together contains spirochaetes and these are capable of penetrating the chitinous covering of the egg. The genital organs contain spirochaetes, as do the salivary glands, and these penetrate the ova. By means of a fine pipette the contents of washed eggs have been withdrawn and long slender spirochaetes have been detected with the ultramicroscope. The contents of 20 eggs injected into a padda failed to infect, but conferred immunity. A fowl's egg which had been incubated for four days was inoculated with the contents of two eggs. On the ninth day after inoculation an emulsion was made of the tissues of the embryo and though spirochaetes could not be detected by direct examination the injection of this material into a padda conferred immunity. The conclusions arrived at are as follows :—

1. The injection of a constant quantity of material obtained by grinding up infected ticks sometimes causes infection and sometimes confers immunity.
2. The infectivity depends upon the number of spirochaetes contained in the ticks.
3. The infective, immunising, and non-infective doses can be measured.
4. All the organs are invaded by the parasite.

5. The spirochaetes pass from the coelom to the acini of the salivary glands and collect in the excretory canal.
6. The salivary secretion is the vehicle of infection.
7. The spirochaetes are present in large numbers in the cephalic glands and are able to penetrate the chitinous membrane of the eggs.
8. The eggs of *Argas persicus* contain spirochaetes, and a single one may contain more than 30.

(50) Launoy (L.) & Lévy-Bruhl (M.). **L'Infection Spirillaire chez les Poules éthyroïdées. Pouvoir Vaccinant de leur Serum.** [On Spirillar Infection in Fowls deprived of the Thyroid Glands, and the Immunising Power of their Serum.]—*Compt. Rend. Soc. Biol.* 1913. Nov. 14. Vol. 75. No. 31. pp. 352-354.

The authors' conclusions are that in adult fowls, which have been infected with *S. gallinarum*, the thyroid glands appear to play no part in the resistance offered to infection nor in the rapidity with which and the extent to which antibodies are formed.

(51) Launoy (L.). **Le Fer du Sang chez la Poule normale et dans l'Infection par le *Spirochaeta gallinarum* Marchoux et Salimbeni.** [The Iron-Content of the Blood in Normal Fowls and in Fowls infected with *S. gallinarum.*]—*Compt. Rend. Soc. Biol.* 1913. Oct. 24. Vol. 75. No. 29. pp. 248-249.

The iron-content of the blood of the fowl is on an average 0·045 per 100 cubic centimetres.

Bleeding does not exert any influence on the blood content.

In blood taken five days after infection with *S. gallinarum* the iron-content is 25 per cent. lower than the average.

(52) Launoy (L.) & Lévy-Bruhl (M.). **Sur l'Anémie observée chez la Poule au Cours de l'Infection par le *Spirochaeta gallinarum.*** [On Anaemia in Fowls in the course of Infection with *S. gallinarum.*]—*Compt. Rend. Soc. Biol.* 1913. Oct. 24. Vol. 75. No. 29. pp. 250-252.

The authors' observations have been made upon the blood of fowls inoculated with an attenuated strain of the spirochaetes; parasites appearing in the blood on the second day, and disappearing on the 5th or 6th.

In normal blood the number of red corpuscles varies from 2,180,000 to 3,160,000. During the course of infection a diminution was observed from the time parasites appeared in the blood and the number steadily fell, until about the 5th day it was reduced by half.

By the 12th or 13th day the number had increased again to the normal.

During the course of the infection very small and very large corpuscles were encountered. In addition to these there were many corpuscles which stained faintly or not at all with eosin. The latter was observed from the 3rd to the 10th day.

(53) Hata (S.). **A Contribution to our Knowledge of the Cultivation of *Spirochaeta recurrens* [*recurrentis*].** (Paper read before the Section of Tropical Med. XVII International Medical Congress, London, 1913.)—*Centralbl. f. Bakt.* I. Abt., Orig. 1913. Nov. 26. Vol. 72. No. 1/2. pp. 107–112. With 1 text-fig.

The author has found that Noguchi's medium for the cultivation of this spirochaete can be modified in such a way as to obviate the necessity of having ascitic fluid and rabbit kidney. He also finds that it is unnecessary to place sterile paraffin upon the top of the medium.

The ascitic fluid can be replaced by horse serum. The serum is mixed with twice its volume of sterile physiological salt solution and the tubes are placed in a water bath at 58° C., the temperature being very slowly raised until in about three hours it stands at 70° C. The tubes are kept at this temperature for 30 minutes. They are then set aside to cool. The medium forms an opaque semi-coagulated mass.

Instead of rabbit kidney the author uses fragments of the "buffy coat" from the coagulum of the horse serum. This is cut into pieces about 1 centimetre in diameter and two or three pieces are pushed down to the bottom of the coagulated medium.

When this medium is inoculated with blood containing the spirochaete and the tubes incubated to 37° C., multiplication occurs by the second day and actively motile spirochaetes can be found in the medium up to the 10th to the 14th day. The virulence of the organism is maintained in this medium better than in Noguchi's. Mice inoculated with a 21 days culture have become infected.

The author has a strain which has been passed through 27 passages in 150 days.

Spirochaetes cultivated at 37° C. will remain alive for about three weeks, but cultures which are kept at room temperature from the 4th or 5th day will retain their vitality for as long as 60 days and possibly longer.

LEISHMANIASIS.

(54) Jannot (A.). **Infection de la Souris avec le Virus de la Leishmaniose Canine Naturelle.** [Infection of Mice with Leishmania from Naturally Infected Dogs.]—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 683-685.

The author has succeeded in inoculating two mice with material taken from the bone marrow of two dogs which were found to be naturally infected in Tunis. From these a number of mice, rats, and gerbils—14 in all—were inoculated, but only two mice became infected. Further passage experiments were not carried out.

(55) Lemaire (G.), Sergent (E.), Lhéritier (A.). **Recherches sur la Leishmaniose du Chien d'Alger.** [Researches on Canine Leishmaniasis in Algiers.]—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 579-581.

In August 1912 the authors took up the examination of the dogs killed in Algiers with the object of ascertaining the percentage infected with leishmania. They were unable to carry on their investigation

continuously throughout the year, but they obtained complete records for the two periods August to November 1912, and April to July 1913.

The results are given in two tables (which appear to contain some arithmetical inaccuracies) and from these it may be gathered that during August and November no infected dogs were found among 44 examined, while during September and October one infected animal was found in each month out of 73 and 88 examined. In this series of animals the examinations involved the preparation of smears from the spleen and bone marrow, four smears being made from each animal.

During the second period of four months, in addition to the preparation of films, cultures were made from the bone marrow.

During this period 272 dogs were examined and seven infected animals were discovered.

It would appear from this that, while the disease can be discovered at all periods of the year, the figures indicate that more cases occur during the months of April and May than during July and August.

It is said that the greater number of cases found during this period is partly due to the fact that a greater number of dogs were examined and to the fact that cultivation was resorted to. In two cases positive cultivations were made when the first examinations of the films had been negative.

A clinical fact noted by the authors is that while some of the infected dogs shew lesions involving the skin, the eyes and the mucous membranes, others shew not the slightest evidence of skin lesions, but only extreme emaciation.

(56) Laveran (A.). **Kala-azar méditerranéen et Kala-azar indien.**—*Bull. Soc. Path. Exot.* 1913. Oct. Vol. 6. No. 8. pp. 574-579.

This paper is a resumé of the report presented by Laveran and Nicolle at the XVIIth International Congress of Medicine held in London in August 1913.

MALARIAL AND OTHER PROTOZOAL PARASITES OF THE BLOOD.

(57) Bruce (David), Harvey (D.), Hamerton (A. E.), & Lady Bruce. *Plasmodium cephalophi*, **sp. nov.**—*Proc. Roy. Soc.* 1913. Oct. 1. Series B. Vol. 87. No. B. 592. pp. 45-47. With 2 plates.

This parasite has been observed in the blood of two duikers in captivity. In one of them the attack was acute and the parasite was present in the blood for four days only. In the other the infection took a chronic course, organisms having persisted in the blood for a period of some months.

The gametes are circular, and the schizonts give rise to 8 to 12 merozoites. Invaded corpuscles shewed marked enlargement and paleness of colour. The pigment is collected into a single mass. There is intense concentration of the portion of the red cell within the food vacuole. The parasite is remarkable for its size, free merozoites sometimes measuring 3·5 by 4 microns, this being about the size of the normal red cell of the antelope. A full-grown schizont before cleavage of the protoplasm may measure 10 microns in diameter.

The duiker in which the infection ran a chronic course was captured

near the lake shore, and parasites were found in its blood a few weeks after its arrival at Kasu Hill. The animal was about three months old. It was probably infected before capture. The other animal was captured on the plateau and had been in captivity for six months before being brought to Kasu. It would appear that its infection was contracted locally.

The infection was discovered at the height of the dry season and though a systematic search was made no mosquitoes could be found.

Another young duiker, a reedbuck and a hartebeeste were in the same compound, but no parasites could be discovered in their blood.

(58) LEGER (M.) & BOUILLIEZ (M.). **Recherches Expérimentales sur *Plasmodium inui* Halberstaedter et Prowazek d'un *Macacus cynomolgus*.** [Experimental Investigations regarding *Plasmodium inui* of *Macacus cynomolgus*.]—*Ann. Inst. Pasteur.* 1913. Nov. Vol. 27. No. 11. pp. 955-985.

This paper is an amplification of those already published by the authors (see this *Bulletin* Vol. 1, Abstracts Nos. 172 and 531). The points dealt with are the following:—morphology, transmission by inoculation, the course of the experimental infection, attempts to transmit the infection to animals other than monkeys, the effects of quinine and splenectomy, attempts to cultivate the parasite, and the identification of the organism.

In the fresh state the parasites appear as round, ovoid, or amoeboid bodies within the corpuscles. Young parasites are difficult to recognise as they do not contain any pigment, and the gametes are distinguishable from the schizonts by the fact that the pigment contained in them is greater in amount and the individual granules are of larger size. The only free parasites seen are the gametes and young merozoites. The authors have never observed flagellation of the microgametocytes.

In stained preparations the following details can be observed. Young schizonts are round in shape and measure rather less than 2 microns in diameter. They are devoid of pigment and their vacuole-like nucleus contains a caryosome. This caryosome is sometimes rounded in shape and centrally placed, but it may be peripherally placed, producing a signet ring appearance. Occasionally two caryosomes are present, and these may be placed at opposite poles of the parasite, or side by side and connected by a delicate filament. A single corpuscle may be occupied by two or three parasites.

In older parasites the caryosome may be curved or rod-like. As the schizont increases in size, it becomes rounded and its protoplasm contains an increasing number of small pigment granules.

The maximum number of merozoites produced by schizogony is 16, and the pigment becomes collected together into a small mass in the centre of the parasite.

Microgametes are rounded or polyhedral, and contain a number of pigment granules scattered through their body. The nucleus, which occupies about a quarter of the parasite, takes the form of a number of rods of chromatin embedded in a pink matrix. Macrogametes are usually larger than the male elements and are often somewhat square in shape. Their protoplasm stains a deep blue tint. The pigment granules are smaller than in the microgametocyte and the nucleus stains deeply.

Red corpuscles containing parasites are not enlarged nor deformed, and they stain as intensely as those containing no parasites. At an advanced stage of infection there is marked anisocytosis with a preponderance of megalocytes, and it is remarkable that these are practically never invaded by parasites, while the microcytes frequently are. Polychromasia is not uncommonly seen, but no punctate basophilia has been observed.

The schizogonic cycle occupies 48 hours.

The parasite does not correspond exactly with any of the three malarial organisms of man, but possesses to some degree the principal characters of all three.

Inoculating intramuscularly, subcutaneously, and intraperitoneally, the authors have passed the virus through seventeen passages, and have infected the following species :—*Macacus cynomolgus*, *M. sinicus*, *M. rhesus*, *M. nemestrinus*, *Cercopithecus callitrichus*, *C. patas*, *C. cephus*, and *Papio anubis*. Two chimpanzees, a *Cercocebus fuliginosus*, and a maki were found to be refractory.

The disease as observed in animals experimentally infected occurs in two forms—acute and chronic.

The acute form is the more frequently seen. Parasites make their appearance in the blood in from 4 to 9 days after inoculation, and death takes place in from 10 to 18 days, the period elapsing between the appearance of parasites in the blood and death never exceeding 10 days. Fifty per cent. of the red corpuscles may be invaded and a single corpuscle may contain three parasites.

At the post-mortem examination there is not always observed enlargement of the liver and spleen, but these organs are grey or even black in colour. Preparations from these organs and from the lungs in some cases shew that there is an abundant infiltration with pigment. This is sometimes free and sometimes included within large mononuclear leucocytes and epithelial cells.

The virulence of the organism was neither exalted nor attenuated by the passages.

In the chronic form of the disease the period of incubation is not sensibly longer than in the acute form, and it is characteristic of this form of the disease that there are periods during which the parasite disappears from the circulation. After their first appearance in the blood they steadily increase in numbers for a time and then disappear either suddenly or gradually. The crisis may last for a week or even a month. During the relapse which follows parasites may be as numerous or slightly less numerous than during the crisis. As a rule there are two relapses and exceptionally three.

During a period of five or six weeks the animal does not appear to suffer in health, but subsequently it becomes dull and ceases to feed. Contrary to what is observed in the acute cases there is sometimes diarrhoea, but the haematuria and haemoglobinuria observed in acute cases have not been seen in chronic ones. The infection causes little or no rise of temperature.

All the monkeys in which the disease took a chronic course, with the exception of one, died after a longer or shorter interval. At the time of death there were no parasites in the blood and none had been observed for a variable length of time previously. Although parasites could not be discovered, the blood of one monkey which survived

223 days proved infective by inoculation. One animal had survived for nine months at the time of writing. The authors have failed to infect animals other than monkeys. Quinine as a prophylactic was found to be of doubtful value, and as a curative to be useless.

Splenectomy was practised upon an animal six months after inoculation when it appeared to have been free from parasites for some time. Parasites again made their appearance in the blood after the operation and the animal died during the following month. The operation was performed upon a second monkey before inoculation and the animal died of the chronic form of the disease four months afterwards.

The authors never observed the morphological changes in the parasite described by BUONIOL as occurring in animals upon which splenectomy had been performed.

Following BASS's technique the authors have succeeded in obtaining a continuation of the development of the parasite in vitro at about 22° C., but subcultures failed in every case. Citrated infective blood kept upon ice proved to be infective five days later and in another instance well stained preparations could be made from blood preserved in a similar manner for a month, but an animal inoculated on the eighth day failed to become infected.

The authors believe that the parasite is *Plasmodium inui* Halberstädter and Prowazek, to which species they also assign *Pl. cynomolgi* Mayer.

(59) JOYEUX (C.). **Note sur quelques Protozoaires Sanguicoles et Intestinaux observés en Guinée française.** [Some Protozoal Parasites of the Blood and Intestines observed in French Guinea.] —*Bull. Soc. Path. Exot.* 1913. Nov. Vol. 6. No. 9. pp. 612-615.

No new parasites are described in this paper, the author's object being to add to knowledge regarding the distribution and frequence of organisms already known.

(60) VISENTINI (A.). **Gli Emoparassiti della Talpa in Italia.** [The Blood Parasites of the Mole in Italy.]—*Arch. f. Protistenkunde.* 1913. Dec. 11. Vol. 32. No. 2. pp. 257-266. With 1 plate.

In 30 per cent. of the moles examined the author has found *Trypanosoma talpae*, and *Elleipsosoma thomsoni* in 4·34 per cent. He has also observed *Grahamella talpae* Brumpt, regarding the parasitic nature of which there appears to be great uncertainty.

(61) MOLDOVAN (J.). **Beitrag zur Entwickelung des *Leucocytozoon ziemanni* (Laveran).** [The Development of *Leucocytozoon ziemanni*.]—*Centralb. f. Bakt.* 1. Abt. Orig. 1913. Sept. 27. Vol. 71. No. 1. pp. 66-69. With 1 plate.

Two screech owls, which had shewn the gametes of this parasite in their blood during life, were examined by the author after death, and in films prepared from the lungs, heart, brain, liver, kidneys and bone marrow young endocellular schizonts were found. In addition to these, young male and female gametes were found. The schizonts contained as many as 30 nuclei. The spleen was not examined.

The young schizonts shew a central nucleus of loose texture surrounded in most instances by particles of chromatin. The cytoplasm is alveolar in structure.

As the parasite increases in size changes are to be observed in the nucleus. This becomes divided into a larger loose-textured portion and a smaller portion of very close texture. The smaller portion takes part in the formation of the nuclei of the schizonts, while the larger portion gradually increases in size, becomes less distinctly marked off, and finally disappears.

The segregation of the cytoplasm around the nuclei and the separation of the merozoites has not as yet been observed.

In a small proportion of the parasites nuclear division does not occur.

TOXOPLASMOSIS.

(62) Pixell (H. L. M.). **Notes on** *Toxoplasma gondii*—*Proc. Roy. Soc.* 1913. Oct. Series B. Vol. 87. No. B. 592. pp. 67-77. With 1 plate.

The parasite proves fatal to mice inoculated intraperitoneally in from five to 15 days. There may be an abundant or scanty peritoneal exudate, and the number of parasites present in this is not in proportion to the amount of exudate. Often parasites are scantily present in cases in which the infection runs an acute course. The parasites in the exudate are either free or enclosed in cells—mononuclear leucocytes or macrophages. Examination of the mesentery shews that the endothelial cells and the connective tissue cells may contain large numbers of parasites. The abdominal and thoracic organs may contain a few.

Multiplication takes place by a process of simple division. Occasionally a number of parasites situated side by side divide in different planes producing an appearance suggestive of cyst formation. Attempts to cultivate the parasite on a number of different media failed.

The author was unable to infect pigeons from mice, and it is stated that Nicolle has observed the same fact.

(63) Carini (A) & Maciel (J.). **Toxoplasmose naturelle du Chien.** [Natural Toxoplasmosis of the dog.]—*Bull. Soc. Path. Exot.* 1913. Dec. Vol. 6. No. 10. pp. 681-683.

Two puppies which were born in the Institute (S. Paulo, Brazil) had been inoculated with the virus of a little-known disease of the dog termed "nambiuvu." The animals died within a fortnight of each other (after an interval which is not stated) and, while the parasite of "nambiuvu" could not be detected, Toxoplasma was found.

Post-mortem examinations were made immediately after death and the following lesions were found:—a small amount of serous exudate in the thoracic and abdominal cavities, some areas of pneumonia in the lungs, and marked hyperaemia of the liver and kidneys. Toxoplasma was especially numerous in the lungs, but it was also found in the liver, kidneys, bone marrow, and spleen.

An emulsion of the organs of each of these dogs was used for the successful inoculation of other dogs and pigeons.

Young dogs are particularly susceptible, and death takes place in from 8 to 12 days, the lesions found at the post-mortem being identical with those encountered in natural cases. Adult dogs as a rule fail to become infected even when massive doses of virus are used.

The pigeons died in from 12 to 19 days. The parasite has been passed through a series of pigeons, and in some instances a symptom which has already been recorded by one of the authors, namely oedema of the eyelids and cloaca, has been observed. The parasite is very numerously present in the oedematous tissue.

In view of the facts that the morphology of the parasite occurring in natural and experimental cases in the dog and pigeon is identical with that found in the rabbit and pigeon, and the pathogenic ranges of *Tox. canis* and *Tox. cuniculi* are the same, it appears to be very doubtful whether the two should be considered to be different species.

HELMINTHS.

(64) Leiper (R. T.). **Seven Helminthological Notes.**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. Part. 3. pp. 175-178. With 1 text-fig. [(*d.*) Flukes in the Dog in Asia. pp. 176-177.]

The trematodes recorded hitherto from the dog in Asia are: *Schistosoma japonicum, Paragonimus westermanii, Clonorchis endemicus,* and *Opisthorchis noverca.* As a result of the examination of material sent from Formosa three further parasites have to be added to the list. These are:—*Heterophyes heterophyes, Yokogawa yokogawa,* and a new species *Centrocestus cuspidatus,* var. *caninus.*

With the exception of the last these flukes are parasitic in man. *Heterophyes* has been found in two instances, in a Chinaman and in a Japanese at the Albert Dock Hospital. *Yokogawa* is said to be sporadic in man and the dog in Korea, Japan, and Formosa. A single specimen of *Centrocestus* was present in a slide of faeces from the dog and, although the parasite closely agrees with that described by Looss as occurring in the kite in Egypt, Leiper follows Looss's ruling and classifies the parasite of the dog as a distinct variety naming it *Centrocestus cuspidatus,* var. *caninus.*

The specimen from the dog differs from that described by Looss in that there are only 28 spines round the mouth instead of 36, but some of the spines may have been lost.

(65) Pricolo (A.). **Sur la Filaire hématique du Chameau.** [On the Blood Filaria of the Camel.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 199-200.

In this paper the author describes the adult forms of the larval filariae found by him in the blood of camels in Tripoli and described in the *Centralblatt für Bakteriologie* 1913, January 11.

He states that he has placed beyond all doubt the relationship between the larvae and the adults.

Filariasis of the camel generally occurs during the hot weather, and the larvae are almost exclusively found in the blood during the night.

Male and female parasites have been found in the blood vessels of

the lung upon two occasions, and in those of the testicles on six. They appear to be capable of escaping easily from the lumen and, except during the first stage of their existence, they do not appear to become attached to the vessel walls.

The lungs in which the author found the parasites shewed calcareous nodules, but the association between these and the worms is doubtful.

In infested testicles there is a condition of hypertrophic sclerosis. The testicles are increased in size and are firmer than normal, the surface presenting a bosselated appearance. Microscopic examination shews that the testicular substance is for the most part replaced by connective tissue.

The female has the appearance of a thick strand of catgut with a slight tinge of pink colouration. The length of the worm is about 22 centimetres and the thickness 666 microns. The head is large, measuring about 140 microns, and it is suddenly constricted posteriorly to form the neck, which is about 117 microns in length and rather more slender than the head. The body of the worm attains its maximum thickness at about the point where the ovaries first become visible. The tail terminates in a truncated point.

The ovaries contain thousands of cells in different stages of development. They are polygonal in outline, measuring about 30 microns in length and varying from 11 to 20 in width.

The eggs contain embryos in different stages of development and measure 32 by 12 to 15 microns.

The male worm resembles a thin strand of catgut and measures from 8 to 12 centimetres in length by 300 microns in thickness. The head, which measures 105 microns, is separated by a very short and slightly marked constriction from the body. The caudal extremity of the body is very slender and is shaped like a corkscrew with three turns.

The presence of the adult worms in the testicles does not apear to give rise to any symptoms. The pathogenic rôle of the larvae has not yet been investigated.

The author suggests the name *Filaria haematica cameli* for the parasite.

(66) Pricolo (A.) **Strongle capillaire du Chameau.** [Strongylus of the Camel.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 4. Vol. 71. No. 2/3. pp. 201-202.

The author has found this parasite in the small intestine of camels in Tripoli.

The males and females are about the same size with the exception that the posterior portion of the male is a little more slender than the corresponding portion of the female.

The worm measures from 5 to 7 millimetres in length and it gradually increases in thickness from the head, which measures about 18 microns, to a maximum of 100 microns, which it attains close to the posterior extremity of the body. The female ends in a short cone. Occasionally there is a small appendage resembling a wing on either side of the head.

The head is curled round in a hook-like manner, but this is probably a post-mortem change. The mouth is unarmed. The uterus appears

to be straight and single, and the eggs which are double-contoured measure 90 by 45 microns.

The anterior extremity of the male worm is not hook-like. At a point 10 microns in front of the bursa is situated the anus which has a brown colour and is shaped like a fork with three prongs. The posterior prong is slender and cylindrical and is directed towards the bursa and terminates in a kind of knob. The two posterior (anterior ?) prongs are wide and flattened, and are directed forwards enclosing a space which is divided into two by two small appendages attached to the anterior prongs.

The worm appears to be of very constant occurrence in the small intestine of the camel, as the author has found it whenever he has made a search. It is frequently associated with haemorrhages, hyperaemia and catarrh of the mucous membrane.

Possibly the worm is that which has been described under the name *Strongylus instabilis* in other mammals.

ANTHRAX.

(67) Holmes (J. D. E.). **A Note on the McFadyean Staining Reaction for Anthrax Bacilli.**—*Agricultural Research Institute, Pusa, Bulletin* No. 36. 1913. pp. 1–3. With 1 plate. (Superintendent Government Printing, Calcutta.)

The author shews that the view expressed by Mitter (*Jl. Trop. Vet. Sci.* Vol. 4, No. 1, pp. 68–70) regarding a supposed difference between the staining reactions of anthrax bacilli in Bengal and in Europe is incorrect, the probability being that the technique of the McFadyean method of staining was incorrectly carried out.

(68) Howard (G. G.). **Anthrax in Elephants.**—*Vet. Record.* 1913. Aug. 2. Vol. 26. No. 1308. pp. 69-71.

This note describes briefly outbreaks in two herds and the author explains that the brief nature of the record is due to the difficulties in the way of obtaining a more detailed one.

The animals involved in the outbreak lived entirely in the jungle at distances varying from 2 to 12 days march from headquarters. During the " off " season (March, April, and May) they are caught once daily and brought into camp for inspection by the head rider and then released again to graze.

At the commencement of the outbreak three animals died and the diagnosis was made upon the examination of blood smears forwarded to headquarters. After forced marching the author arrived at the infected area on the following day and found another animal shewing signs of illness. The animal was dull and had a haggard look. There was a swelling on the right side just below the scapula which was hot and painful. Examination of the blood while the animal was still alive shewed that a few anthrax bacilli were present in it. The animal died early the following morning, six hours after the bacilli had been found in the blood, and at the time of death bacilli were very numerously present.

The same day another animal was observed to be dull, and to have

a watery discharge from the eyes. In this case also there was a small well-defined swelling below the right scapula resulting in lameness. In both of these animals it was impossible to get any temperature taken on account of their viciousness. The swelling was continuously fomented with hot water and on the fourth day it burst in three places. Bacilli were not found in this animal's blood, and although the animal lost greatly in condition it eventually recovered. On the day that this animal was first observed to be ill another elephant shewed symptoms and it died on the following day, anthrax being confirmed by microscopic examination. Three days later another animal died of anthrax and one other became ill but recovered. In four of the animals there was a swelling on the right side.

RABIES.

(69) Noguchi (H.). **Contribution to the Cultivation of the Parasite of Rabies.**—*Jl. Experimental Med.* 1913. Sept. Vol. 18. No. 3. pp. 314-316. With 1 plate.

This paper contains a brief account of what the author claims to be the parasite of rabies in artificial cultures. The method employed was that used for the cultivation of the spirochaete of relapsing fever.

In cultures made either from the "street," "passage," or "fixed" virus minute granular and coarser pleomorphic chromatoid bodies make their appearance and these can be found in sub-cultures through many generations. The smallest of these bodies are just on the borders of visibility with a 2 mm. lens. On a number of occasions the author has observed in certain cultures rounded or oval nucleated structures provided with an enclosing membrane and quite different in appearance from the granular bodies. The appearance of these bodies in the cultures was sudden and after persisting for four or five days they disappeared, their disappearance coinciding with an increase in the number of small granular bodies.

Experimental inoculation of dogs, rabbits, and guinea-pigs with cultures containing the nucleated or the granular bodies has given rise to rabies, as shewn by the typical symptoms and positive animal inoculations, the granular and nucleated bodies being found in the brains of the animals so infected.

A paper substantially the same as this appears in the *Revue Vétérinaire*, 1913. Oct. Vol. 30, No. 10, pp. 592–595.

(70) Levaditi (C.). **Virus Rabique et Culture des Cellules "in vitro."** [The Virus of Rabies and the Cultivation of the Cellules in vitro.] —*Compt. Rend. Soc. Biol.* 1913. Dec. 12. Vol. 75. No. 35. p. 505.

In this preliminary note the author states that using the technique of Burrows, Harrison and Carrel he has succeeded in cultivating spinal gangalia of rabid monkeys in monkey plasma. The pieces have been transferred to fresh plasma regularly every five or six days. It has been found that the virus of rabies preserves its virulence for the rabbit for at least a month at 37° C. Rabbits inoculated at each passage with portions of the cultivated ganglia have contracted rabies.

The two rabbits inoculated into the brain with the virus of the 5th passage and after thirty days cultivation became rabid on the 10th and 11th days.

Full details regarding the technique and the results of microscopic examination will be given in a future paper.

(71) Luzzani (Mme L. N.). **Le Diagnostic de la Rage par la Démonstration du Parasite Spécifique. Resultats de Dix Ans d'Expériences. (Première Partie.)** [The Diagnosis of Rabies by the Demonstration of the Specific Parasite (First Part.)]—*Ann. Inst. Pasteur.* 1913. Nov. Vol. 27. No. 11. pp. 907-924.

This article contains the author's views regarding the parasitic nature of Negri bodies and a brief description of a process of spore formation in which the central nucleus divides into a number of pieces, each of which has separated off round it a portion of the general body substance. The bulk of the paper is made up of a summary of the reports and statistics published by a large number of authors and a repetition of the various methods of staining that have been devised for the demonstration of Negri bodies. It is stated that while in cases of furious rabies the bodies are to be found in Ammon's horn, the cerebral cortex and cerebellum, in cases of dumb rabies they may be absent from these situations but present in the spinal ganglia and spinal cord.

(72) Luzzani (Mme L. N.). **Le Diagnostic de la Rage par la Démonstration du Parasite Spécifique. (Deuxième Partie.)** [The Diagnosis of Rabies by the Demonstration of the Specific Parasite. (Second Part.)]—*Ann. Inst. Pasteur.* 1913. Dec. Vol. 27. No. 12. pp. 1039-1062.

The author advises the adoption of the following procedure for the detection of Negri bodies in suspected material. In any case the hippocampus should first be examined if that be available. Transverse sections are cut from the fresh specimen and scrapings are taken from the cut surface. These are examined in the moist state without staining by spreading them out on a slide with a little dilute acetic acid. A plate is given shewing the appearance presented by the nerve cells containing the bodies.

Should this method fail, a thin slice of the hippocampus is fixed in Zenker's fluid for four hours and then washed in water, after which scrapings are taken from the cut surface and treated in the same manner as the fresh specimens. In the event of a negative result the thin slices are rapidly dehydrated and passed through chloroform and embedded in paraffin. The sections are stained by Mann's method.

Reference is then made to cell inclusions other than Negri bodies and the literature concerning them is discussed at some length. The characters of those found in cases of distemper are contrasted with those found in rabies.

The author draws attention to the discovery in the cells of the hippocampus and of the cerebellum of small cell inclusions in the brains of healthy cats. These stain red with Mann's method, but they have not the typical structure of Negri bodies.

The paper includes tabulated results of examinations made by the author.

(73) Bertarelli (E.) & Melli (C.). **Experimentelle Untersuchungen über die Pseudolyssa.** [Experimental Investigations regarding False Rabies.]—*Centralbl. f. Bakt.* 1. Abt., Orig. 1913. Oct. 11. Vol. 71. No. 4. pp. 286-291.

The following points were investigated by the authors :—

1. The filtrability of the virus.
2. The infectivity of the peripheral nerves.
3. Whether the virus can pass along the course of nerves.
4. Whether cell inclusions comparable to those found in rabies occur in the nerve cells of the central nervous system and spinal ganglia.

The only one of these points which has already received attention at the hands of experimenters is the first.

The virus used was obtained from Carini.

In the first filtration experiment the brain of a rabbit infected by subcutaneous inoculation was mixed with 10 cc. of physiological salt solution and filtered at a pressure of one atmosphere through a new Berkefeld filter which had been tested with *B. prodigiosus.* Two rabbits inoculated respectively subcutaneously and subdurally with the filtrate failed to become infected.

In the second filtration experiment the " virus " was macerated for several hours in salt solution and then greatly diluted (no details given). This liquid was filtered at $\frac{3}{4}$ atmosphere pressure. The filtrate was centrifuged and used to inoculate one rabbit intraperitoneally and another subdurally. In both cases the result was negative.

A portion of the sciatic nerve of a rabbit which had died three days after subcutaneous inoculation was ground up in a mortar with salt solution, the liquid being used to inoculate rabbits subcutaneously and intraperitoneally. Neither of the rabbits died.

Another rabbit was inoculated with a similar liquid prepared from the sciatic nerve of a rabbit which had died as a result of inoculation into the sciatic nerve of the opposite side. The result was again negative.

The experiment was repeated with the sciatic nerve taken from a dog which had died as the result of subcutaneous inoculation from a rabbit. In this case also the result was negative. From these experiments the conclusion is drawn that the peripheral nerves are non-infective, this being in marked contrast to what is the case in rabies.

To ascertain whether the virus traverses the course of the nerves an animal (species unstated) was inoculated into the sciatic nerve which had been exposed and isolated with pads of wool. Death occurred with typical symptoms two days later.

As soon after death as possible the inoculated nerve was removed, ground up with salt solution, and used for the subcutaneous inoculation of two rabbits. Both died of the disease. The brain of one of these rabbits proved infective when inoculated into another animal.

A rabbit inoculated into the sciatic nerve which had been ligatured above the seat of inoculation failed to become infected. The same result was obtained when a rabbit was inoculated from a portion of

the sciatic nerve cut out above the seat of inoculation immediately after the inoculation had been performed.

Infection followed the inoculation of a very small quantity of virus into the muscle of the gluteal region which was exposed for the inoculation in order to avoid injuring any nerve trunk.

The conclusion that naturally follows from these results is that the virus can become disseminated not only along the course of nerves but in some other manner also. Some of the experiments suggest, however, that the dissemination of the virus along the nerve trunks is specific as is the case in rabies. It is said to be possible that the dissemination of small quantities may take place through other channels.

The authors have examined the brain of only one dog with the object of ascertaining whether bodies resembling Negri bodies are present, and only a single body in any way resembling a Negri body was found.

RINDERPEST.

(74) Braddon (W. L.). **Some Peculiar and Probably Specific Bodies in the Erythrocytes in Rinderpest and another Allied Disease.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 265-275. With 1 plate.

The author's observations were made in connection with the production of a protective serum for buffaloes in the Malay States.

For the detection of the bodies described a special method of treating the blood is essential, the method being one which the author has been in the habit of using for blood-studies.

Method. The blood is diluted with a mixture containing 1 per cent. of citrate of potash and 0·5 per cent. of ordinary medicinal methylene blue. Different proportions of the fluid must be added varying from one-fifth to one-third of the volume of blood, according to the condition of the latter, which as taken from the vein may be almost tarry or excessively hydraemic.

"Of the mixture, some specimens are put up under cover-glasses, sealed at the edges with a paraffin of low melting-point; other portions are put in watch glasses exposed to the air, but not to light, and are kept in Petri dishes arranged as moist chambers. When examination reveals the presence of the specific bodies in these preparations, films may be spread in the ordinary way, and fixed as permanent specimens."

Appearances presented by the bodies. After a period varying from 6 to 48 hours there appears upon the blood corpuscle a blue point, from which there later develop one or more delicate fine lines going deeper into the corpuscle. These lines by extending and thickening usually demarcate a long slender needle- or sword-shaped body which may extend into, across, or through the corpuscle.

The bodies may be straight or curved, may present a single or double contour and may vary considerably in width. The ends may be pointed or oval. In some cases the protruding ends of the bodies carry the membrane of the corpuscle with them. The bodies may appear to be in one plane, bent, twisted, or folded. A single cell may contain one or more such bodies.

The bodies may be completely extruded from the corpuscles, and many filamentous and lanceolate forms may be seen either attached by one end to the corpuscle or free in the plasma.

In specimens taken from acute cases when near the crisis none of these forms may be found, but corpuscles shewing a minute speckling with blue points may be seen. In a small number of corpuscles fewer granules of a larger size may be observed, and in some of these the granules may have a comma-like form.

The presence of the endoglobular bodies is indicated in the author's opinion in other ways. The blood corpuscles undergo an alteration of outline, appearing as though a slice of variable size had been cut off from one side. Measurement is said to shew that there is in reality no loss of substance, but that the alteration of shape is due to some pressure exerted by a body within the corpuscle. The author has been unable to demonstrate this body within the corpuscle by staining.

Movements. Within the first 24 hours of observation corpuscles and particularly those which appear to have had a portion sliced from them shew active movement. Rapid oscillations lasting for a short time are combined with rotatory changes in position. The effect is an exaggerated Brownian movement, and the corpuscles actively jostle one another.

Within the corpuscles, even when in a fairly advanced stage of staining and after several days of observation, the bodies shew movements of their own. They bend and unbend, twist or rotate sluggishly on their long axis, change position within the corpuscles; when attached by one extremity to the exterior of the corpuscle they sway freely in the plasma and vibrate with a limited range. The free forms move through the plasma shewing movements of rotation, bending and unbending.

Relation to disease. The bodies have been found invariably in all cases of acute rinderpest during the febrile stages, and in the great majority of cases up to eight months after recovery.

In artificially infected animals which have first been proved to be free of these forms they appear as early as the third day after inoculation. From this date they increase rapidly in numbers, and even in serum-protected animals three-quarters of the corpuscles may become invaded. Their appearance precedes the onset of pyrexia by several days and thus forms a valuable means of detecting contacts.

In animals less susceptible than buffaloes the bodies are smaller, less numerous, and less active. In successive reactions following the injection of virus into immunised animals there is also a progressive diminution in number and size.

In one of two domestic pigs inoculated numerous slender forms were found in the blood on the fourth day. In goats which act as passive carriers of the virus (which in them is active from the 4th to the 8th day after inoculation), the bodies could not be distinguished in any of the shapes occurring in cattle, but tapering filaments were observed to be protruding from opposite sides of the corpuscles, and these were observed to continue unaltered in shape for ten days or more.

A *New Rinderpest-like Malady.* The author's attention was drawn to a disease among buffaloes which resembled rinderpest in its clinical features and in the post-mortem findings, but which occurred as a limited epizootic and caused only a low mortality.

Examination of blood from these cases by the author's method failed to reveal the bodies observed in true rinderpest, but shewed an intracorpuscular body of a different kind.

In nearly every corpuscle a short thick rounded, ovoid, angular, or nearly square body could be seen. They stained of a dark green to a blue black colour and appeared to consist of a vesicle measuring from $\frac{1}{2}$ to 3 microns in diameter distended with stain. They appeared to have a tendency to protrude from the corpuscles but none were found absolutely free.

Remarks as to technique. The only method by which the author has been able to stain more than the mere margins of the bodies is as follows:—The specimen, having had any excess of mercury (sublimate is the best fixative) and blue washed off, is immersed in the original solution for five minutes and overstained. It is then washed and treated for 10 seconds only with a mixture of 2 per cent. orange G., 1 per cent. Anilin blue, and 2 per cent. Oxalic acid in water. Wash quickly with water, absolute alcohol, acid alcohol, and again water. In successful specimens the corpuscles have a green tint and the specific bodies have a deep brown colour.

It appears to be essential that the stain in the first instance should be applied to the unfixed corpuscle.

(75) Johnson (J. C.). **Observations on Mammalian Erythrocytes.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 276-278.

The observations recorded in this short paper were carried out with the object of ascertaining whether any appearances resembling those described in Braddon's paper on rinderpest could be discovered in the blood of healthy and diseased animals.

Normal blood was examined from a man, two dogs, two rabbits, a white rat, a calf, and a ram. The diseased animals from which blood was taken for examination included a calf infected with *Theileria parva*, three dogs suffering from acute piroplasmosis, two dogs suffering from chronic piroplasmosis, and a horse "salted" against infection with *Nuttallia equi*.

Several specimens of blood were taken from each animal by running it into marked tubes containing Braddon's mixture, and in proportions varying from $\frac{1}{6}$ to several times the volume of staining fluid.

With the blood of normal animals it was found that the quantity recommended by Braddon was insufficient to prevent coagulation.

Four methods of examination of the erythrocytes were adopted:

1. A drop of mixture from the tubes was transferred to a slide, covered, and ringed with vaseline.

2. Coverglass films were made from the mixtures, fixed wet over formalin, or with saturated mercuric chloride, and mounted in balsam.

3. Films of fresh blood were made at the time of collection, and treated with either Giemsa's or Leishman's stain.

4. For correlation with the above, unstained films were observed of the blood mixed with Hayem's solution.

A great many films had to be rejected owing to osmotic changes in the red blood corpuscles.

In specimens in which the mixtures were correctly made, so as to avoid change in the histological characters of the blood corpuscles, the solution recommended by Braddon was found to be an excellent preservative for blood films. Several ringed films kept in perfect condition for over a month.

After prolonged examination of many films the author concluded that :—

1. The appearances of the erythrocytes in the morbid conditions examined were easily differentiable from those described by BRADDON.

2. Normal blood corpuscles from the above sources presented nothing like his description of the alleged parasite of rinderpest, which tends to support his view that what he describes is specific to that disease.

MISCELLANEOUS.

(76) MINETT (E. P.). **Report of Epidemiological Survey and Investigation into Probable Causes of Sickness amongst Mules on Plantations Bath, Blairmont, Providence and Springlands, British Guiana.**—*Jl. Trop. Med. & Hyg.* 1913. Dec. 1. Vol. 16. No. 23. pp. 362-364.

The disease which is briefly described in this paper has been the cause of death of a number of horses and mules in the districts mentioned. The period of incubation is uncertain, but probably amounts to several weeks at the most. The symptoms are :—Loss of condition, progressive anaemia, paralysis of the hind quarters and in some cases haemoglobinuria. Jaundice was seldom observed. Acute cases terminate fatally in 3 weeks, while chronic ones may last for 6 months. The lesions found are as follows :—Anaemia of all the organs, haemorrhages under the serous membranes, no enlargement of the spleen. No trypanosomes were found and examination for meningococcus was negative. Sections of the spinal cord shewed a small amount of round-celled infiltration around the capillaries.

In a Supplementary Report on Mule and Horse Disease in the County of Berbice it is stated that smears of blood taken during the febrile period shewed large numbers of trypanosomes "closely resembling *T. equinum*."

(77) HADWEN (S.). **On "Tick Paralysis" in Sheep and Man following Bites of *Dermacentor venustus*. With Notes on the Biology of the Tick.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 283-297. With 2 plates.

History of the disease. During the spring of the years 1910 to 1913 complaints were received from Keremeos, British Columbia, that a peculiar form of paralysis among sheep had been observed.

In 1911 an outbreak occurred among 900 sheep imported from Montana, and during March and the first week in April 46 old sheep were lost.

From March 1st to 15th 1912, 34 yearling sheep were affected and 10 died. In May, June and July about 300 were affected, and about 80 died. These is no definite information that these were affected in the same way, but it was said that they were suffering from a form of paralysis.

From March 25th to April 5th 1913 five yearlings were paralysed, but none died.

The author proceeded to the district in April, and though he saw no recent cases some which had been affected were shewn to him. The

animals had just been shorn and on examining one of them a large tick which had been cut in half was found attached to its back.

Surrounding the tick was a large discoloured area and this caused the suspicion that the disease was due to the bites of ticks.

Recently papers have been published recording the occurrence of a peculiar form of paralysis occurring in human beings as a result of tick bites.

On returning to Agassiz the author was able to reproduce the disease experimentally with ticks brought from the district where the naturally contracted cases had occurred.

In at least one instance it was found that the removal of a tick from an affected animal was followed by prompt recovery.

The explanation of the occurrence of a few cases only in lambs lies in the fact that by the time they are taken up to the hills the ticks have practically disappeared for the season.

The tick season around Keremeos may begin as early as February and does not extend much beyond May, but the author was informed that occasionally a few ticks were observed on sheep during the autumn and that cases were sometimes encountered during that part of the year.

Nature of the disease and symptoms presented. The disease occurs in sheep and man, and probably in other species also, and is caused by the bite of *Dermacentor venustus*.

The tick has a decided preference for biting along the spinal column, but it remains to be shewn whether the disease is produced by the bites of the tick on any other portion of the body. The tick certainly produces serious local effects wherever it may bite.

The disease is said in some cases to last for months.

Reports have been received regarding the occurrence of a disease of the same or a similar nature in colts, dogs, rabbits and grouse.

In the sheep symptoms of paralysis occur in from 6 to 7 days after the ticks have become attached to them, and the only lesions found at the post-mortem are subcutaneous haemorrhages where the ticks have been attached and congestion of the brain and cord. Attempts to transmit the disease by inoculation have failed and no parasites have been discovered in the blood or nerve tissues.

Broth cultures prepared from diseased animals have remained sterile. The probable explanation of the disease is that it is due to toxins injected by the ticks and that these are elaborated at a time when engorging is rapid, that is 24 hours before the ticks drop off.

The average time occupied by female ticks in becoming engorged was 6½ days.

The period of incubation suggests that the disease may be of microbic origin and it is possible that the causal agent has not been recognised, but the fact that no fever has been recorded and inoculation experiments have proved negative rather contra-indicates this.

The fact that old sheep were attacked during the first year and that only yearlings were subsequently diseased suggests that an attack of the disease confers immunity. This does not interfere with the toxin theory of the disease.

So far there seems to be no evidence connecting the paralysis observed among the sheep with Rocky Mountain fever, the only other disease transmitted by *D. venustus*.

The disease develops somewhat slowly and in cases where recovery is about to take place the first stages towards recovery also are prolonged, after which progress is rapid.

It is suggested that the removal of ticks and dipping would prove of benefit in the treatment of the disease.

The male ticks attach and detach themselves, causing haemorrhage at every bite. The blood seems to have lost its power of coagulation.

Position of ticks on the host. In the immense majority of cases the ticks are situated along the line of the spinal column, both in the natural and in the experimental cases.

The following are given as probable reasons why the ticks select the line of the back as their point of attachment :—

1. There is frequently a parting in the wool along the back.
2. The ticks are likely to be brushed off on to the back when the animals pass under bushes.
3. All the denuded portions of a sheep's body are greasy.
4. The wool is very thick on all other parts of the body except on the brisket where ticks are occasionally found.

In animals other than sheep, including man, the favourite seat of attachment appears to be the neck, but in horses they are found in the perineal region also.

Of 87 ticks collected from sheep 53 were females and 34 males.

In view of the fact that the male tick frequently attaches itself without any females being present, it is more dangerous than the male of any other species—if the male is capable of producing the disease, a point which requires elucidation.

(78) Hadwen (S.) & Nuttall (G. H. F.). **Experimental "Tick Paralysis" in the Dog.**—*Parasitology.* 1913. Oct. Vol. 6. No. 3. pp. 298-301.

The dog used in this experiment had been used fourteen months previously for a piroplasmosis experiment, and had made a complete recovery after treatment with trypanblue.

The ticks used were collected in June 1913 and on July 8th a single female was placed upon the dog. On the following day the tick attached itself on the right side of the neck just in front of a line joining the scapular angles. On the ninth day symptoms of paralysis appeared, the hind quarters being affected. Sensation in the hind legs was unimpaired. On the following day the fore limbs were affected, and the dog could only raise its head a little. There was incontinence of urine and loss of appetite. During the next three days the breathing was laboured and the animal had to be fed, the paralysis persisting. From the 14th day the symptoms began to subside and by the 16th day the dog was as well as ever. On the 18th day the tick was removed about two-thirds engorged.

On July 25th a single female was placed each upon a horse and a jackal. Both ticks attached themselves, but did not engorge to repletion and failed to produce any effects.

In 1912 a number of experiments were carried out with guinea-pigs and some ticks obtained from eggs of *D. venustus*.

In the first experiment larvae and then nymphs were placed upon guinea-pigs, but the result was entirely negative.

In the second experiment larvae were placed on a guinea-pig and they dropped off engorged in from 3 to 6 days. Eight days later nymphs began to emerge. These were placed upon a guinea-pig which died on the 6th day after their application.

In the third experiment larvae were placed upon a guinea-pig which died on the 5th day. Some of the nymphs obtained were placed upon a guinea-pig which died on the 7th day. Others were placed upon a ram's scrotum without producing any effect. The adults were also without any effect when placed upon a ram's scrotum.

(79) Williams (A. J.). **Notes on an Outbreak of Horse Sickness connected with the Presence of Lyperosia as a possible Transmitter.** —*Veterinary Jl.* 1913. Aug. Vol. 69. No. 458. pp. 382-386

In this article the author describes the occurrence of an outbreak of horse sickness under conditions which suggested that Lyperosia might be the transmitting agent. The cases occurred at Dilling and later at El Obeid, in November and December 1908.

The first two cases occurred in animals that had been at Dilling for some time, and the subsequent cases among the horses of a squadron of cavalry which had arrived there from Kordofan.

The first case occurred among the cavalry horses on the 6th day after the first horse died and the 7th after their arrival. The second case in this batch of animals occurred a week later.

The horses were then moved to El Obeid, ninety miles away. There seven cases occurred and it appeared to be probable that in five of these the infection was contracted before the horses left Dilling. After their departure for El Obeid three further cases occurred at Dilling, making 14 in all.

Attention is drawn to the following points:—

No cases occurred among horses purchased locally. The symptoms and course of the disease were absolutely typical. Horse sickness is known by the Arabs to occur in the district, which is sandy and desert-like, and where during the dry season water is obtained from wells 60 feet deep. The disease is known to make its appearance with the first rains and to disappear with the onset of the cold season. Enquiries shewed that several cases had occurred in the locality and it was considered to be unusual that cases should occur so late in the year.

There were no mosquitoes in the district, and the only biting fly found was *Lyperosia minuta*, and the author thinks that taking all the circumstances into consideration it appears to be not improbable that this fly was the transmitting agent, carrying the infection directly from horse to horse.

(80) Kuhn (P.). **Bemerkungen zu der Arbeit von Dr. H. Sieber "Experimentelle Untersuchungen über die Pferdesterbe."** [Observations on Dr. Sieber's Article "Experiments in connection with Horse Sickness."]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.* 1913. Oct. Vol. 14. No. 4/5. pp. 316-320.

This paper contains some criticisms of an article published by Sieber in the same journal in 1911 (Vol. 10, No. 2/3).

(81) JOWETT (W.). **Pulmonary Mycosis in the Ostrich.**—*Jl. Comp. Path. & Therap.* 1913. Sept. Vol. 26. No. 3. pp. 253-257. With 1 text-fig.

Although the author was unable to carry out experiments to identify the causal organism encountered in the lesions described in this article, the fact that the lesions differed markedly from those encountered by ARCHIBALD in the Sudan (see this *Bulletin* Vol. 1, No. 5, 1913, p. 316) appeared to warrant the publication of a note.

The cases occurred in birds from three to five years old and the period of visible illness was probably very short, though no definite information was forthcoming on this point. The lesions were found in the lung tissue only, the trachea and bronchi being free from macroscopic alterations. The lungs were congested and hepatised, and on section were found to be crowded with small yellowish tubercles rather larger than pins' heads. The tubercles were shot-like in consistence and could not be enucleated from the surrounding lung tissue.

On section they were found to be composed of three zones—a central necrotic zone containing numbers of thick-walled, branching, segmented filaments, a middle zone composed of leucocytes and epitheloid cells, through which many mycelial filaments passed in a radiating manner, and a peripheral zone in which the lung tissue shewed evidence of croupous inflammation.

The filaments measured from 2 to 4 microns in diameter and the older ones, which had very thick walls, resisted the penetration of stains. Free spores were fairly numerous and measured up to 4 microns in diameter.

"Mouldy" grape husks were thought to have been the vehicle of infection.

(82) VINCENZO (Z.). **Sul *Criptococcus farciminosus* di Rivolta.** [The Cryptococcus of Rivolta.]—*Il Moderno Zooiatro.* Parte Scientifica. 1913. Sept. 30. Vol. 24. No. 9. pp. 381-385.

This paper contains a general survey of the author's observations regarding the nature of the organism, and he concludes that the parasite is not a protozoon but that it belongs to the saccharomycetes.

(83) MARSHALL (C. H.). **Experiments with the *Micrococcus melitensis*.**—*Jl. London School Trop. Med.* 1913. Nov. Vol. 2. No. 3. pp. 220-223.

This short paper contains the records of a few experiments carried out with the object of increasing the virulence of the organism and to test the effect of "606" upon the course of the disease.

The author's conclusions are as follows :—

A few passages of the *Micrococcus melitensis* through the guinea-pig are insufficient to naturally increase the virulence for that animal.

The slightly increased virulence obtained by a few passages of the organism through guinea pigs does not increase the virulence of the strain for rabbits.

The injection of "606" appears to have a definite inhibitory effect on *M. melitensis* when injected into the experimental animal shortly after inoculation with the organism.

When the original dose of "606" is insufficient to prevent infection a subsequent dose appears to have a definite curative effect.

REPORTS.

(84) NYASALAND PROTECTORATE. **Annual Report on the Department of Agriculture for the Year ending March 31, 1913. Veterinary Division.** (GARDEN, E.)—Zomba: Printed at the Government Press. [Price 6d.]

This report deals with (1) The Veterinary Congress on Rinderpest held at Bulawayo (the resolutions passed are printed verbatim), (2) Trypanosomiasis, (3) Piroplasmosis, (4) Demodectic Mange, (5) Black Quarter, (6) Ophthalmia in Cattle, (7) Swine Fever, and (8) Dipping. The specimens examined during the year are given in a tabular statement.

Four outbreaks of trypanosomiasis are recorded, principally on or near the Zomba-Blantyre Road. No details regarding the magnitude of the outbreaks or the causal trypanosome are given.

Theileria parva is known to occur in the Protectorate and the presence of *B. mutans* is strongly suspected.

The spread of demodectic mange among cattle has rendered notification necessary. Slaughtering of the affected and regular dipping of the whole herd is advocated as the only means of eradicating the disease.

Although the presence of Black quarter in the Protectorate is suspected, proof of its existence has not yet been furnished.

Two forms of ophthalmia in cattle are met with, viz., "Specific" which has been dealt with in a previous report, and "Verminous."

Verminous ophthalmia is caused by nematode worms which measure 10–14 mm. (female) and 20–24 mm. (male) in length.

"The parasites are readily seen gliding over the surface of the eye and in between the folds of the mucous membrane."

They are often found in tangled masses under the membrana nictitans.

Swine Fever made its appearance in the Protectorate in October 1912, the infection being traceable to Rhodesia. Fortunately the area involved was restricted, and owing to the villages being widely separated the disease died out.

Attention is emphatically drawn to the necessity of establishing tanks and undertaking systematic dipping for the eradication of ticks and tick-borne diseases.

(85) SOUTHERN RHODESIA. **Report of the Chief Veterinary Surgeon (SINCLAIR, J. M.) for the Year 1912.**

African Coast Fever. During the year five outbreaks occurred, as compared with eight in 1911 and eighteen in 1910. The total mortality including animals slaughtered on account of a rise of temperature was 505. Of these 409 occurred at one centre.

Dipping has been found to be of immense value in controlling this and other diseases. The value of the method of dealing with the disease is evidenced by an account of the occurrence of the disease on the Umtali commonage. After a period of freedom lasting for several years a case occurred in January 1910. Three-day dipping was

resorted to and, although the cattle were not removed from the infected veldt, only four further deaths have occurred in two years.

Contagious Pleuro-pneumonia. A single case of this disease occurred at a farm close to the Bechuanaland Protectorate border, and since the last case of the disease recorded in the whole Territory occurred in 1904 it appears to be probable that it was introduced from Bechuanaland where it has existed for years. Quarantine and restriction of movement regulations were in force for three months and no further outbreaks occurred.

Anthrax. Two outbreaks occurred involving the loss of fourteen pigs, one donkey, and six head of cattle. The only record of a previous outbreak of anthrax in Southern Rhodesia is that which occurred at Ramaquabane in 1898.

Bovine Plasmoses. The immunity conferred by an attack of redwater gradually declines unless reinforced by constant re-infection by means of ticks. It has been observed that the dipping practised for the eradication of African Coast Fever has resulted in a decrease in the immunity against redwater and gall-sickness (anaplasmosis). It has also been observed that the strain of anaplasma has increased in virulence during the last year or two.

In order to establish immunity in imported stock the local virus must be used. The virus obtained from Pretoria did not confer complete immunity.

Black Quarter. No recurrence of the disease is reported.

Ovine anaplasmosis. The existence of this disease in various districts throughout the Territory has been demonstrated. The symptoms are anaemia, cachexia, and oedema of the intermaxillary space (bottle jaw).

Trypanosomiasis. Although tsetse fly exist to a considerable extent in the Sebungwe, Lomagundi, and Hartley districts, the diseases transmitted by them to domesticated animals are not of great economic importance from a veterinary point of view.

The only outbreak of any importance recorded during the year was the loss of 20 head of native cattle in the Sebungwe district. It is only in grossly infested areas that stock farming is impossible. Encouraging results have been obtained in the treatment of trypanosomiasis by the Veterinary Bacteriologist (Bevan), but it is not thought advisable to publish an account of the method of treatment at present.

Importation of cattle from North-Eastern Rhodesia was suspended owing to the possibility that the animals might convey the human trypanosome, and it was suspended from North Western Rhodesia on account of the existence of "Shesheke cattle sickness" which appears to be a fatal form of trypanosomiasis occurring in an area free from tsetse flies.

Rabies. Outbreaks have occurred in eight or nine districts, but no figures are given. It is said that there is good reason for believing that the disease exists among the wild carnivora.

Horse Sickness. No statistics are available, but not more than a dozen deaths were reported.

(86) Southern Rhodesia. **Report of Veterinary Bacteriologist (Bevan, Ll. E. W.) for the Year 1912.**

Bovine Plasmoses. See Abstract 478, Vol. 1 of this *Bulletin.*

Horse Sickness. Experiments regarding immunisation against this disease have been carried out on fifteen animals and seven of these have withstood inoculation with virus.

Trypanosomiasis. See Abstract 487, Vol. 1 of this *Bulletin.*

In that abstract it is stated that further reference will be made to the trypanosomes appearing in two of the rabbits inoculated.

These rabbits were inoculated, one from a dog and one from a sheep, and a trypanosome of the *pecorum* type made its appearance in the blood. These trypanosomes were carried on in sub-inoculations.

A number of cattle were detained at Feira on account of the possibility of their conveying human trypanosomiasis. Three dogs and nine sheep were inoculated from them. Two of the dogs died of an infection of the *pecorum* type in 28 and 44 days. Four sheep became infected with a mild disease caused by a trypanosome of the same type. " In none of the animals have trypanosomes of the nagana type been encountered. In view of the large percentage of buck found by Kinghorn and Yorke to be infected with the so-called *T. rhodesiense* in the Luangwa Valley, this result is somewhat significant."

(87) Uganda Protectorate. **Annual Report of the Department of Agriculture for the Year ended March 31, 1913.** Report of the Chief Veterinary Officer (Hutchins, E.), 1913. Kampala: Printed by the Uganda Company Press.

East Coast Fever. Owing to pressure of other duties little has been done during the year regarding this disease save mapping out areas in which it is endemic.

Rinderpest. During the year rather over 38,000 cattle in the Eastern Province were immunised against this disease. Approximately 30,000 of these were treated by the mixed method, a dose of virulent blood being administered at the same time as protective serum. The mortality seldom exceeded 5 per cent.

Trypanosomiasis. T. pecorum is responsible for the heaviest losses. In certain districts half the affected herds were carried off by the disease and there appears to be good reason for believing that in Bugerere and Buruli the disease is of recent introduction. The Eastern Province is particularly free from trypanosome infection but so far as is known there is nothing in the distribution of the biting flies which would account for this, but possibly the absence of big game is the real explanation.

Epizootic lymphangitis is widely prevalent and it is said that it can be arrested if treatment is undertaken in time, but it is doubtful if a permanent cure is ever effected.

Two fatal cases of horse sickness were seen during the year.

Restrictions have been imposed upon imported dogs, as rabies has been reported as occurring in jackals in British East Africa.

Trypanblue has proved to be effectual in the treatment of the majority of cases of piroplasmosis in the dog.

(88) Uganda Protectorate. **Report of the Tour in South Africa, undertaken by** Richardson (U.F.), **Veterinary Officer.** [MS.]

The tour described in this report was undertaken for the purpose of studying (1) East Coast Fever, particularly methods of inocula-

tion. (2) Trypanosomiasis. (3) Diseases of stock occurring in South Africa which may become of economic importance in Uganda. (4) South African methods of regulating cattle transport.

East Coast Fever. The importance of this disease in Uganda lies in the facts that: (1) There are parts of the country which have never suffered from the disease and others in which it is endemic, and cattle removed from the one to the other die from it. (2) In some parts of the country the raising of young stock is severely handicapped by East Coast Fever occurring in young calves (Amakebbe) and causing a mortality of from 1 to 80 per cent., according to the district. (3) Imported cattle quickly die of the disease. Reference is made to the procedures adopted in Southern Rhodesia and the Union of South Africa for dealing with the disease. In the former quarantine, movements of cattle to clean pastures and dipping are said to have given fairly satisfactory results. The same plan associated with slaughter of affected animals is giving good results in the Union. It is suggested that where dipping is found unsatisfactory it is probably due to want of care. Inoculation with spleen and gland pulp is said to give very irregular results, the reason for which is unknown.

Pulp made from the organs of an animal actually dying from the disease is believed by the officers in the field to be too powerful a material to be used as a vaccine. It is believed that the best material is obtained from an animal just after the remission of temperature. Richardson believes that inoculation might be resorted to with advantage in Uganda, but that it does not appear to offer much hope of dealing with Amakebbe.

Trypanosomiasis. With regard to the transmission of trypanosomiasis, it is said to be the general opinion of veterinary officers in Portuguese East Africa and Rhodesia that permanent fly areas are kept infective by tsetse flies, and that cattle which have become infected in these areas act as reservoirs outside the fly belts, the transmitting agents there being Tabanidae.

BOOK REVIEW.

(89) Holmes (Major J. D. E.). [M.A., D.Sc., M.R.C.V.S., Imperial Bacteriologist.] **A Description of the Imperial Bacteriological Laboratory, Muktesar; Its Work and Products.** 47 pp. With 33 plates. 1913. Superintendent Government Printing. Calcutta. India. [Price 8 annas, or 9 pence.]

This little volume is full of interest and instruction, particularly to those who have not had the opportunity of working in India. The difficulties encountered in the application in the field of the results of the laboratory investigations are clearly shewn, and the manner in which these difficulties have been overcome to a great extent plainly indicates the value of the laboratory work.

The book is divided into five chapters dealing with (1) A Short History of the Laboratory, (2) A Description of the Laboratory Site and Buildings, (3) The Research Work and Publications of the Laboratory, (4) The Practical Application of Serum and Vaccines, and (5) The Products of the Laboratory.

The chapter on the Research Work and publications will be found of great value when it is desired to refer to the literature concerning the diseases of stock in India.

Chapters 4 and 5 deal in a concise manner with the preparation and practical application of the various sera and vaccines prepared at the laboratory, and it is from these chapters particularly that a clear idea is obtained of the immense difficulties that have been and are being overcome.

The half-tone plates give an excellent idea of the general arrangement of the laboratory and its equipment, shewing especially the size to which the Station, which was opened in 1895 with a laboratory, post-mortem house, cattle shed, bungalow, and cattle-kraal, has grown.

RECENT LITERATURE.

[Continued from *Bulletin* Vol. 1, No. 5, pp. 321-326.]

Babesiasis (Piroplasmosis).

(90) MARTOGLIO (F.), STELLA (V.), & PROVENZALE (F.). Sulla Recettività dei Bovini somali verso il *Piroplasma bigeminum*.—*Ann. d'Igiene Sperimentale*, 1913. Vol. 23. (New Ser.). No. 3, pp. 315–324. With 3 charts.

(91) NUTTALL (George H. F.). The Herter Lectures. III. Piroplasmosis.—*Parasitology*, 1913. Oct. Vol. 6. No. 3, pp. 302–320. With 14 text figs.

(92) SABRAZÈS (J.) & BONDEAUD (Aug.). Note sur Quelques Cas Piroplasmose canine observés dans le Sud-Ouest de la France.—*Gaz. Hebdomadaire des Sci. Med. de Bordeaux*, 1913. Oct. 12. Vol. 34. No. 41, pp. 490–491.

(93) THOMSON (J. G.). & FANTHAM (H. B). The Culture of *Babesia* (*Piroplasma*) *canis* in Vitro.—*Ann. Trop. Med. and Parasit.* 1913. Dec. Vol. 7. No. 4, pp. 621–630. With 5 text figs. and 1 plate.

Epizootic lymphangitis.

(94) HARBER (A. F.). Epizootic Lymphangitis and its Treatment.—*Veterinary Jl.*, 1913. Sept. Vol. 69. No. 459, pp. 408–414.

(95) KENNEDY (W.). Epizootic Lymphangitis.—*Agric. Jl. of B. E. Africa*, 1913. March. Vol. 5. Part 1, pp. 43–47.

Filariasis.

(96) STEFKO (W.). La Filariose des Oiseaux de la Russie Centrale.—*Bull. Soc. Path. Exot.*, 1913. Oct. Vol. 6. No. 8, pp. 592–594.

Leishmaniasis.

(97) CANNATA (S.). Sul Reperto del Parassita di Leishman nel Sangue periferico. [The Detection of Leishmania in the Peripheral Blood].—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.-[Sept. Vol. 4. No. 5, pp. 303–306.

(98) CARONIA (G.). Sul Potere complementare del Siero di Sangue nella Leishmaniosi infantile. [The Complement Content of Blood Serum in Infantile Leishmaniasis.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 309–313.

(99) SCORDO (F.). Alterazioni morfologiche dei Corpi del Leishman nel Kala-Azar. [Morphological Changes in Leishman's Bodies in Kala-Azar.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 313–317.

(100) SPAGNOLIO (G.). Sul la Ganglio-puntura nella Diagnosi di Leishmaniosi. [Gland Puncture in the Diagnosis of Leishmaniasis.]—*Malaria e Malat. d. Paesi Caldi*, 1913. Aug.–Sept. Vol. 4. No. 5, pp. 306–308.

Rabies.

(101) MEJÍA (Carlos Ramos). Rabia y Salvarsan.—*Semana Medica*, 1913. Dec. 4. Vol. 20. No. 49 (No. 1038), pp. 1315–1318.

(102) MOON (V. H.). The Organism of Rabies and Experiments in its Artificial Cultivation.—*Jl. Infectious Diseases*, 1913. Sept. Vol. 13. No. 2, pp. 232-235.

(103) POOR (D. W.) & STEINHARDT (Edna). A Study of the Virus of Rabies, freed from the Cells of the Host and from Contaminating Organisms.—*Jl. Infectious Diseases*, 1913. Sept. Vol. 13. No. 2, pp. 203–231.

Rinderpest.

(104) Holmes (J. D. E.). Rinderpest. Further Investigations on Questions connected with the Economical Production of Antiserum.—*Memoirs Dept. Agriculture in India.* Vet. Ser., 1913. Nov. Vol. 2. No. 2, pp. 33–80.

(105) Oliver (E. W.). Note on Rinderpest.—*Bulletin* 28, *Agricultural Series.* Issued by the Dept. of Land Records and Agriculture, United Provinces of Agra and Oudh.

(106) Wölfel (K.). Rinderpest in Deutsch Ostafrika. [Rinderpest in German East Africa.]—*Zeitschr. f. Infektionskrankh. parasit. Krankh. u. Hyg. d. Haust.*, 1913. Dec. 24. Vol. 14. No. 7, pp. 429–457. With 1 map.

Spirochaetosis.

(107) King (W. E.) & Hoffmann (G. L.). *Spirochaeta suis*, its Significance as a Pathogenic Organism. Studies on Hog Cholera.—*Jl. Infectious Diseases*, 1913. Nov. Vol. 13. No. 3, pp. 461–498. With 1 plate and 3 text figs.

(108) Lebailly (C.). Sur les Spirochètes de l'Intestin des Oiseaux. —*Compt. Rend. Soc. Biol.*, 1913. Nov. 21. Vol. 75. No. 32, pp. 389–391.

(109) Swift (H. F.) & Ellis (A. W. M.). A Study of the Spirochaeticidal Action of the Serum of Patients treated with Salvarsan.—*Jl. Experim. Med.*, 1913. Oct. Vol. 18. No. 4, pp. 435–449.

Trypanosomiasis.

(110) Holmes (J. D. E.). A Further Note on the Cure of Surra in Horses.—*Indian Civil Vet. Dept. Memoirs.* No. 3, pp. 73–77.

(111) Holmes (J. D. E.). Some Cases of Surra treated in the Field and in the Laboratory during the Autumn of 1911.—*Memoirs of the Dept. of Agriculture in India.* Veterinary Series, 1913. Aug. Vol. 2. No. 1, pp. 1–31.

(112) Kleine (F. K.) & Fischer (W.). Schlafkrankheit und Tsetsefliegen. II. Mitteilung. [Sleeping Sickness and Tsetseflies.]—*Zeitschr. f. Hyg. u. Infektionskrankh.* 1913. Aug. 27. Vol. 75. No. 2, pp. 375–382.

Undulant Fever.

(113) Sèjournant (J.). La Fièvre Mediterranéenne en Algérie en 1912. [Undulant Fever (Malta Fever) in Algeria in 1912.]—*Ann. Inst. Pasteur*, 1913. Oct. Vol. 27. No. 10, pp. 828–838.

Biting Insects.

Flies.

(114) Carpenter (G. D. H.). Second Report on the Bionomics of *Glossina fuscipes* (*palpalis*) of Uganda.—*Report Sleeping Sickness Commission Roy. Soc.*, 1913. No. 14., pp. 1–37. With 36 figs.

(115) Chalmers (A. J.) & King (H. H.). The Distribution of *Glossina longipennis* (Corti, 1895).—*Jl. Trop. Med. and Hyg.*, 1913. Oct. 15. Vol. 16. No. 20, pp. 320–322. With 1 map.

(116) Fiske (W. F.). The Bionomics of Glossina: a Review with Hypothetical Conclusions.—*Bull. Entomol. Research*, 1913. Sept. Vol. 4. Part 2, pp. 95–111.

Biting Insects—*cont.*

Mosquitoes.

(117) THEOBALD (F. V.). New Culicidae from the Sudan.—[*Mucidus nigerrimus*, nov. sp., *Chrysoconops nocturnus*, nov. sp., *Reedomyia sudanensis*, nov. sp., *Kingia maculoabdominalis*, nov., sp., *Aedimorphus quinquepunctata*, nov. sp., *Culicelsa centropunctata*, nov. sp., and *Heptaphlebomyia kingii*, nov. sp.]—*Ann. Trop. Med. and Parasit.*, 1913. Dec. Vol. 7. No. 4, pp. 591–602.

Ticks.

(118) ROBINSON (L. E.) & DAVIDSON (J.). The Anatomy of *Argas persicus* (Oken, 1818). Part II.—*Parasitology*, 1913. Oct. Vol. 6. No. 3, pp. 217–256. With 4 plates and 8 text figs. (For Reference to Part I see Ref. 584, Vol. 1 this *Bulletin*.)

Protozoa.

(119) O'FARRELL (W. R.). Hereditary Infection, with special reference to its Occurrence in *Hyalomma aegyptium* infected with *Crithidia hyalommae*.—*Ann. Trop. Med. and Parasit.*, 1913. Dec. Vol. 7. No. 4, pp. 545–562. With 3 plates.

(120) RATZ (S. von). Trichomonas aus der Leber der Tauben. [Trichomonas in the Liver of the Pigeon.]—*Centralbl. f. Bakt.* 1. Abt. Orig., 1913. Oct. 4. Vol. 71. No. 2 3, pp. 184–189.

(121) WENYON (C. M.). Observations on *Herpetomonas muscae domesticae* and some Allied Flagellates. With Special Reference to the Structure of their Nuclei.—*Arch. f. Protist.*, 1913. Sept. 25, pp. 1–36. With 3 plates, 6 text figs. and 1 diagram.

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(122) COMINOTTI (L.). L'Anemia infettiva del Cavallo. [Equine Infectious Anaemia.]—*Clinica Veterinaria*, 1913. Nov. 30. Vol. 36. No. 22, pp. 983–996.

(123) ELLIS (A. W. M.) & SWIFT (A. F.). The Effect of Intraspinous Injections of Salvarsan and Neosalvarsan in Monkeys.—*Jl. Experim. Med.*, 1913. Oct. Vol. 18. No. 4, pp. 428–434.

(124) KNUTH. Weitere Beobachtungen über *Haemaphysalis punctata* als wahrscheinlichen Ueberträger des Erregers der inneren Verblutung (Milzruptur) beim Rinde. [Further Observations regarding *Haemaphysalis punctata* as the Probable Transmitting Agent of the Cause of Internal Haemorrhage (Rupture of the Spleen) in Cattle.]—*Berl. Tier. Wochenschr.*, 1913. Nov. 20 and 27. Vol. 29. Nos. 47, 48, pp. 832–833 and 853–854.

(125) LEWIS (J. C.). Veterinary and Stock Report and some of the Diseases in Stock in the Northern Territory.—*Bull. of the Northern Territory*, 1913. July. No. 8, pp. 35. With 18 plates.

(126) MITRA (Satyendra Nath). On a Peculiar Form of Pasteurella in an Indian Elephant.—*Centralbl. f. Bakt.* 1. Abt. Orig., 1914. Feb. 11. Vol. 73. No. 1, pp. 12–13. With 1 text fig.

(127) MONTFALLET (D.). Contribution à l'Étude des Maladies du Sang du Bétail de Chile, 1913. Imprimerie Franco-Chilienne, Rue Villa Vicencio 315, Santiago de Chile. pp. 1–23.

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